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POPULAR SCIENCE

MONTHLY

June 35¢

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PAGE 90

Solar Heat Will Cool New Homes
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He's America's No. 1 Sports Driver

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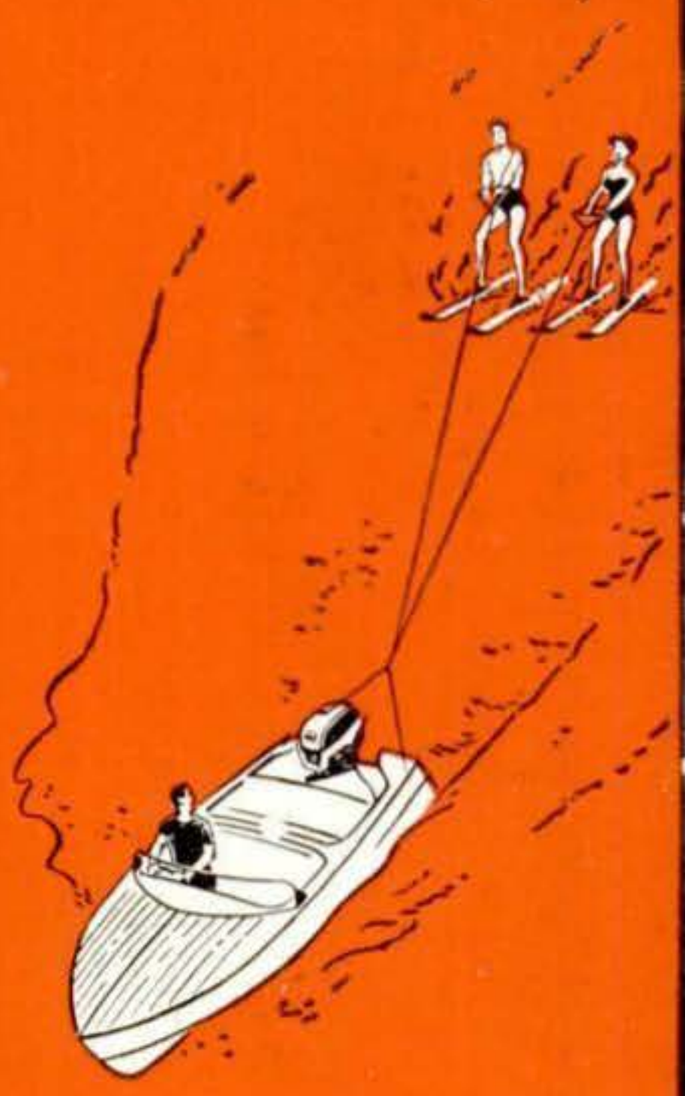

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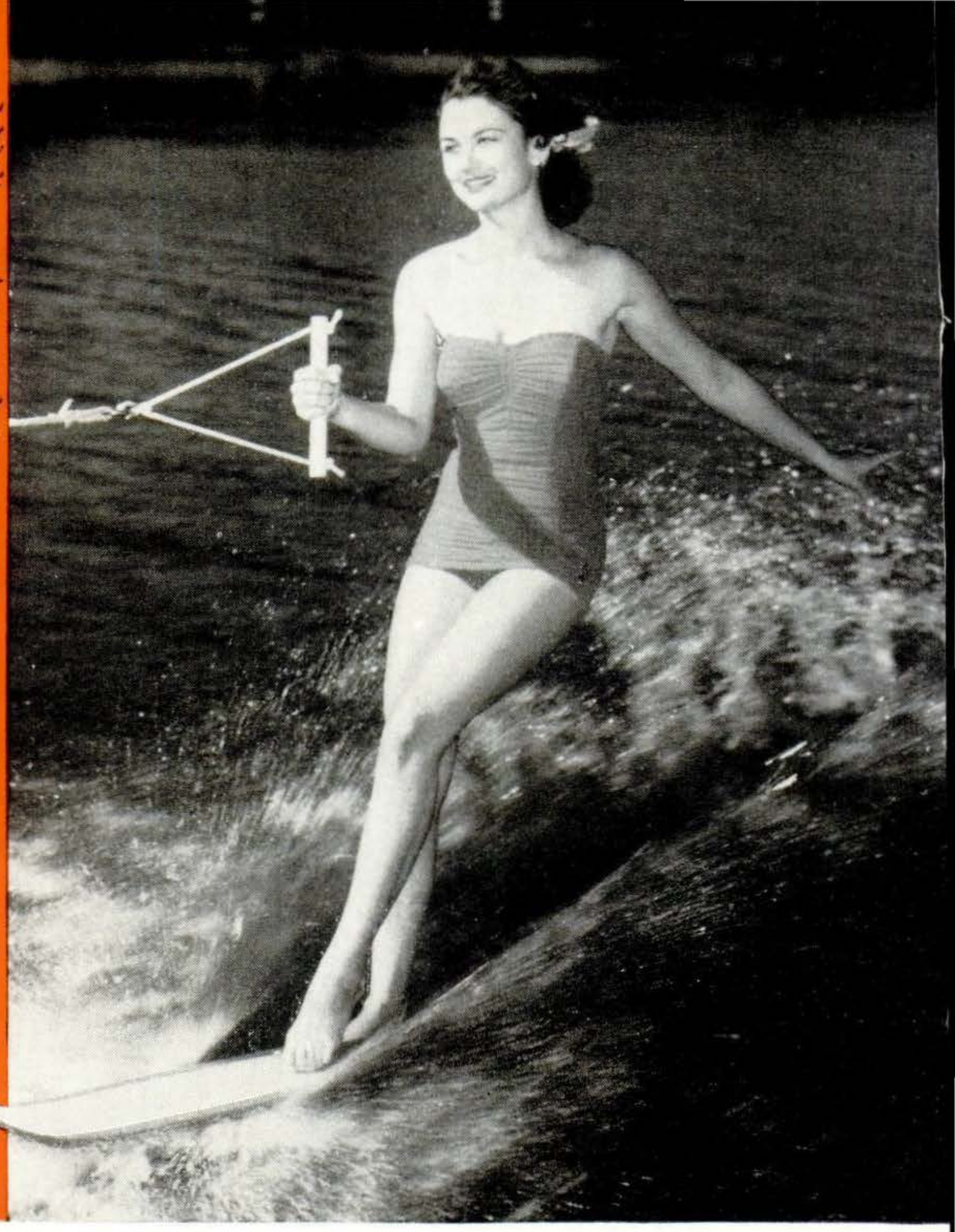

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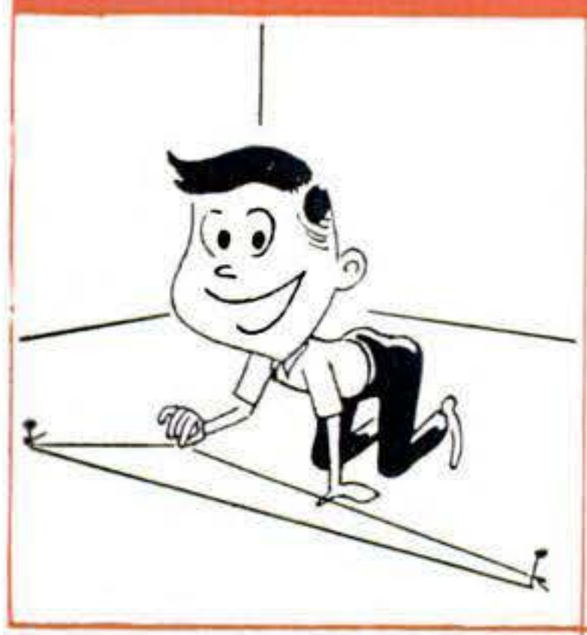

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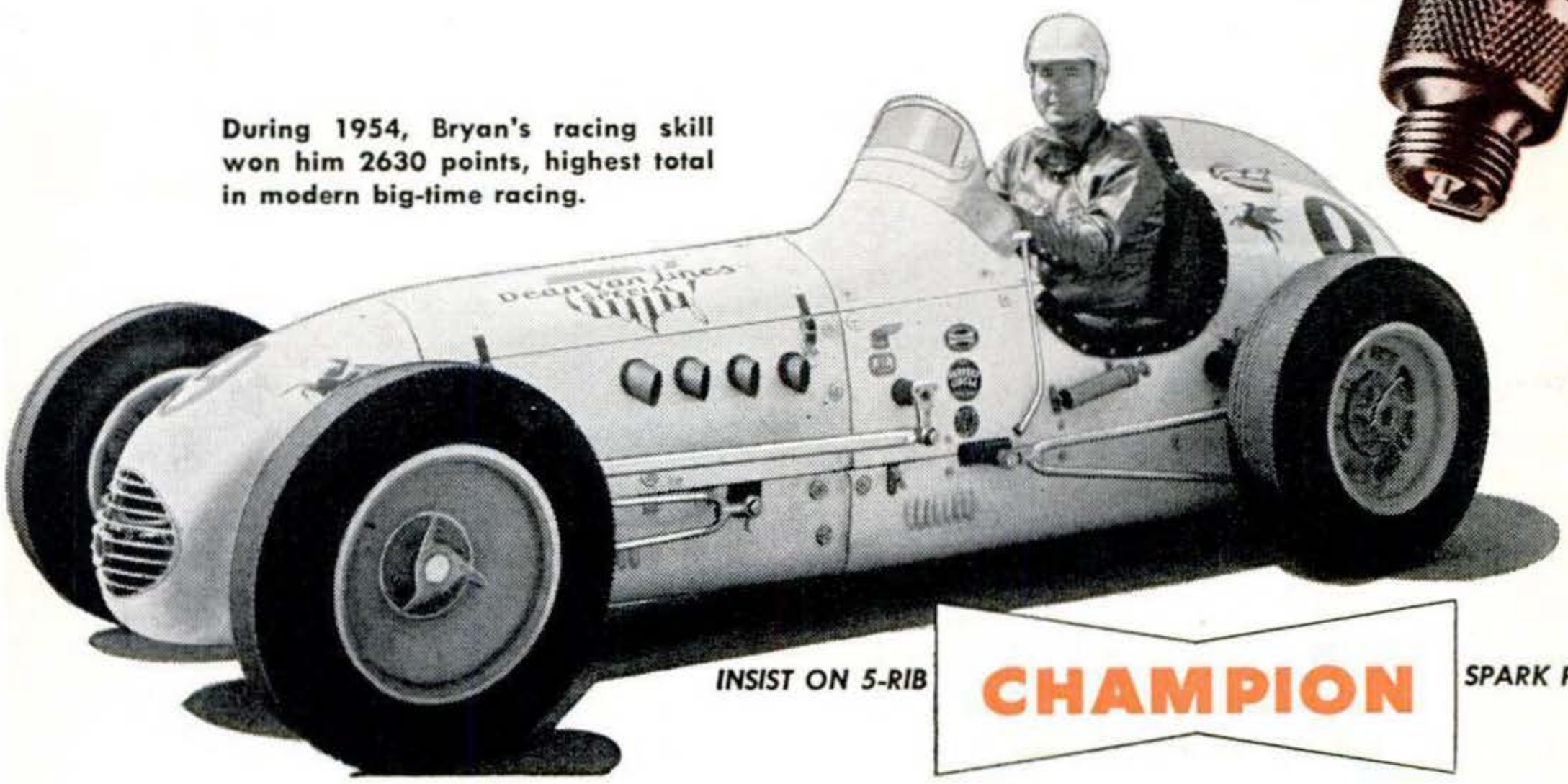

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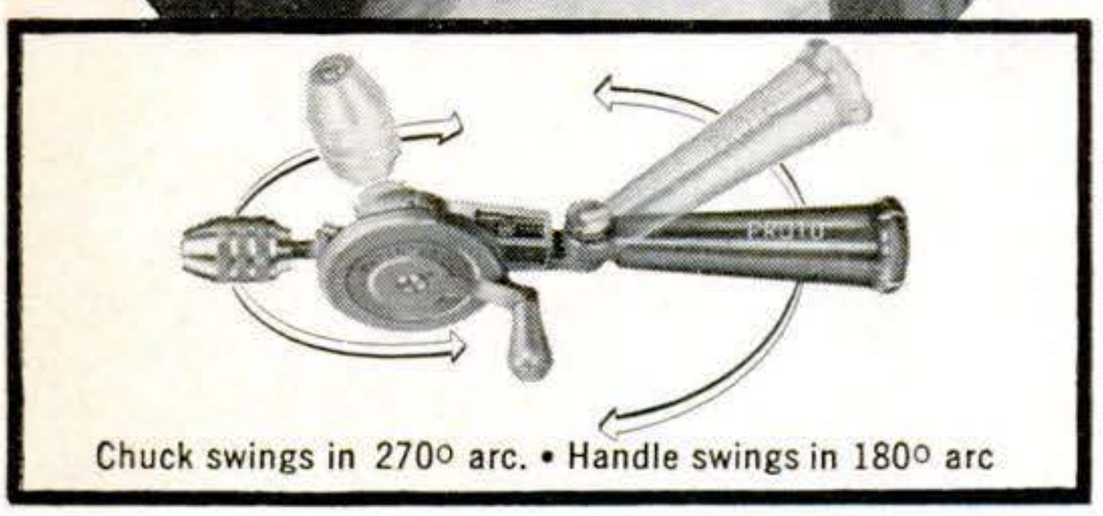

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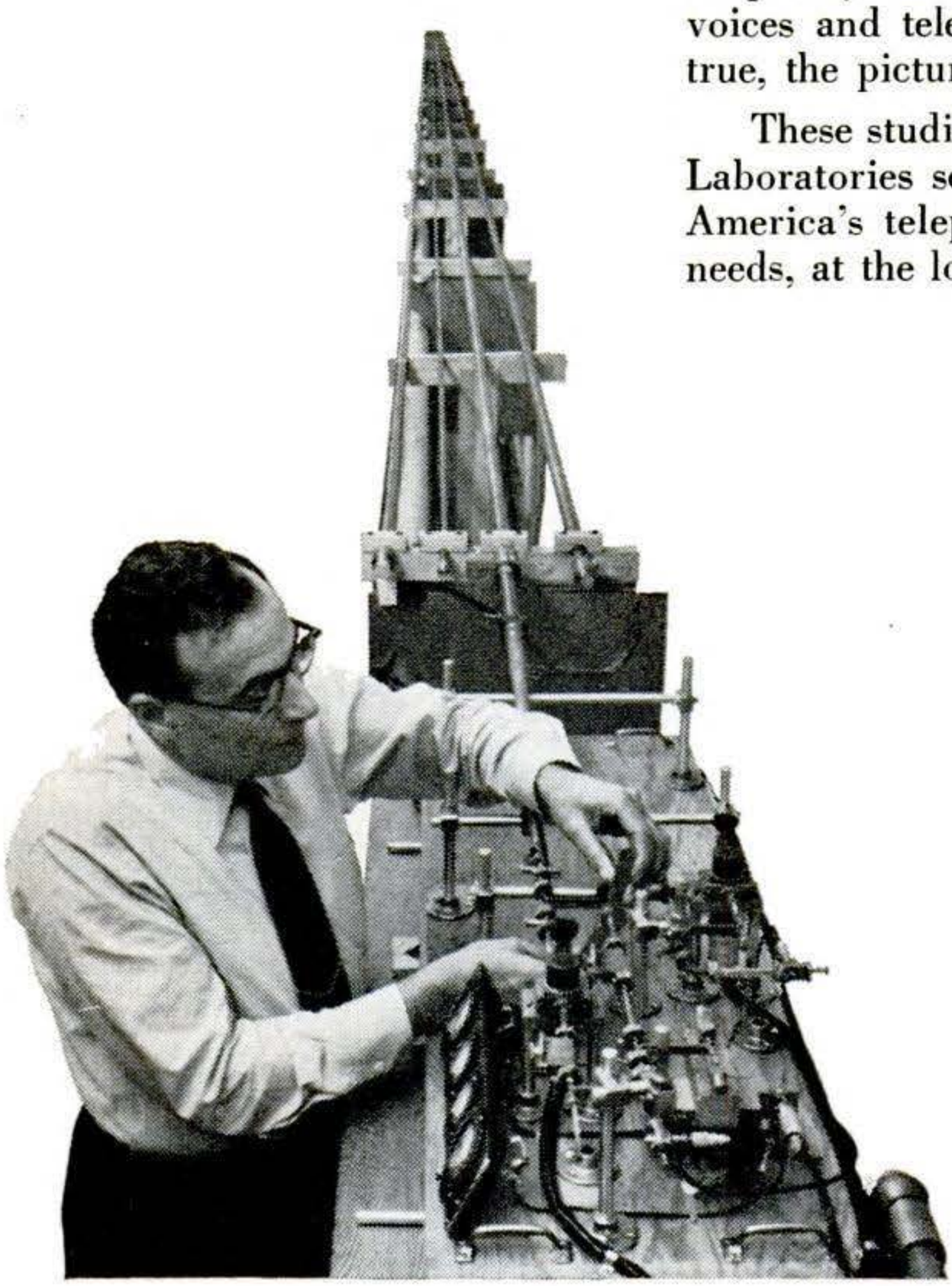
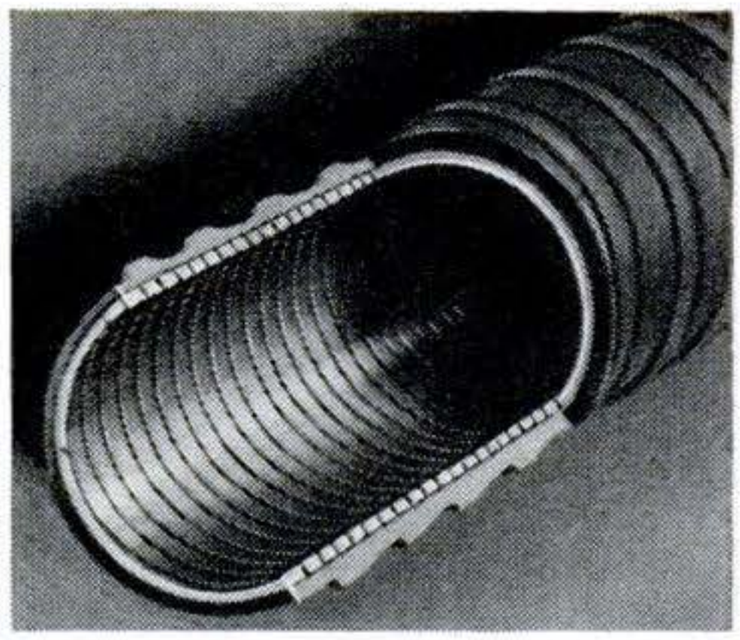
Unlike wires or coaxial, these pipes have the unique property of *diminishing* power losses as frequencies rise. This means that higher frequencies can be used. As the frequency band widens, it makes room for many more voices and television programs. And the voices will be true, the pictures faithfully transmitted.

These studies illustrate once more how Bell Telephone Laboratories scientists look ahead. They make sure that America's telephone service will *always* meet America's needs, at the lowest possible cost.



Testing round waveguides at Bell Telephone Laboratories, Holmdel, New Jersey. Unlike coaxial cable, waveguides have no central conductor. Theoretically, voice-capacity is much greater than in coaxial cable.



New type of waveguide pipe formed of tightly wound insulated wire transmits better around corners than solid-wall pipes.

New type waveguide is bent on wooden forms for study of effect of curvature on transmission. The waveguide itself is here covered with a protective coating.

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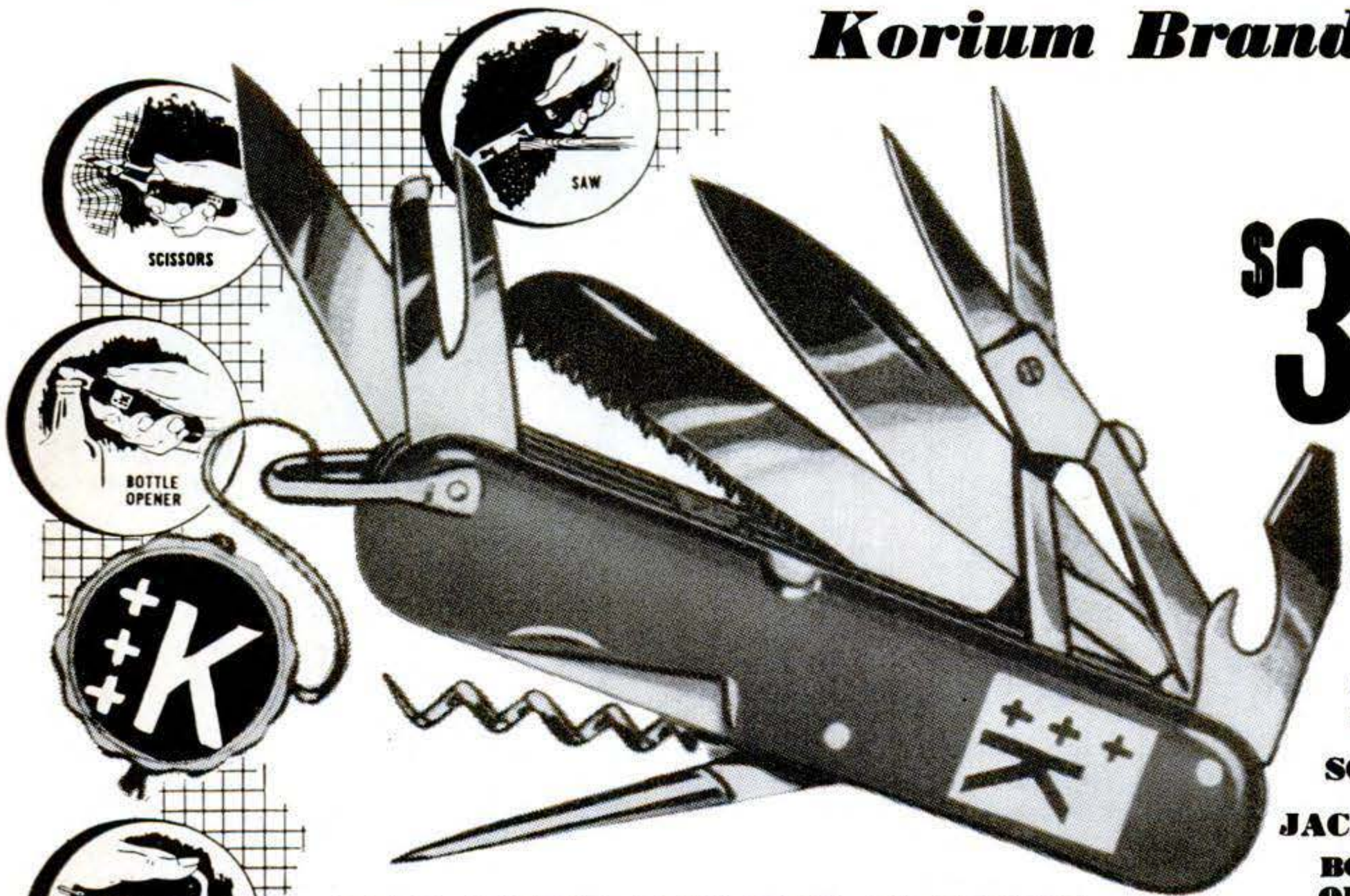

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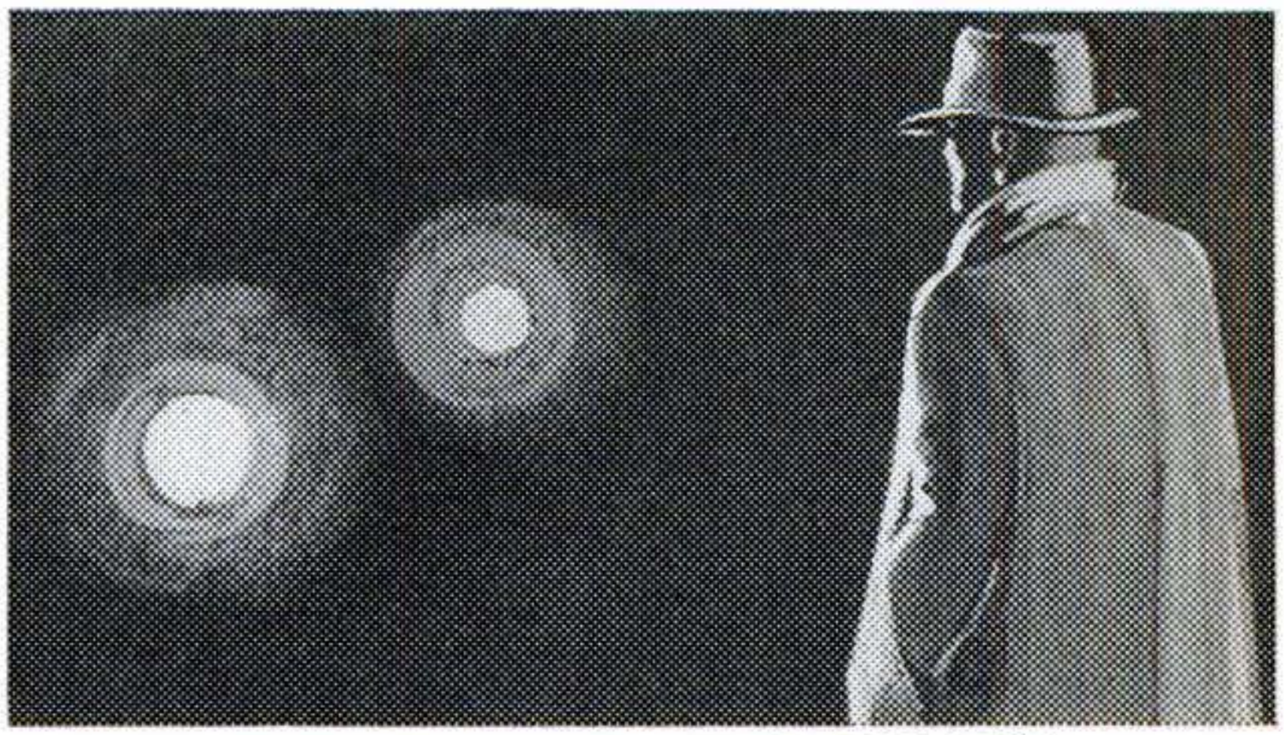

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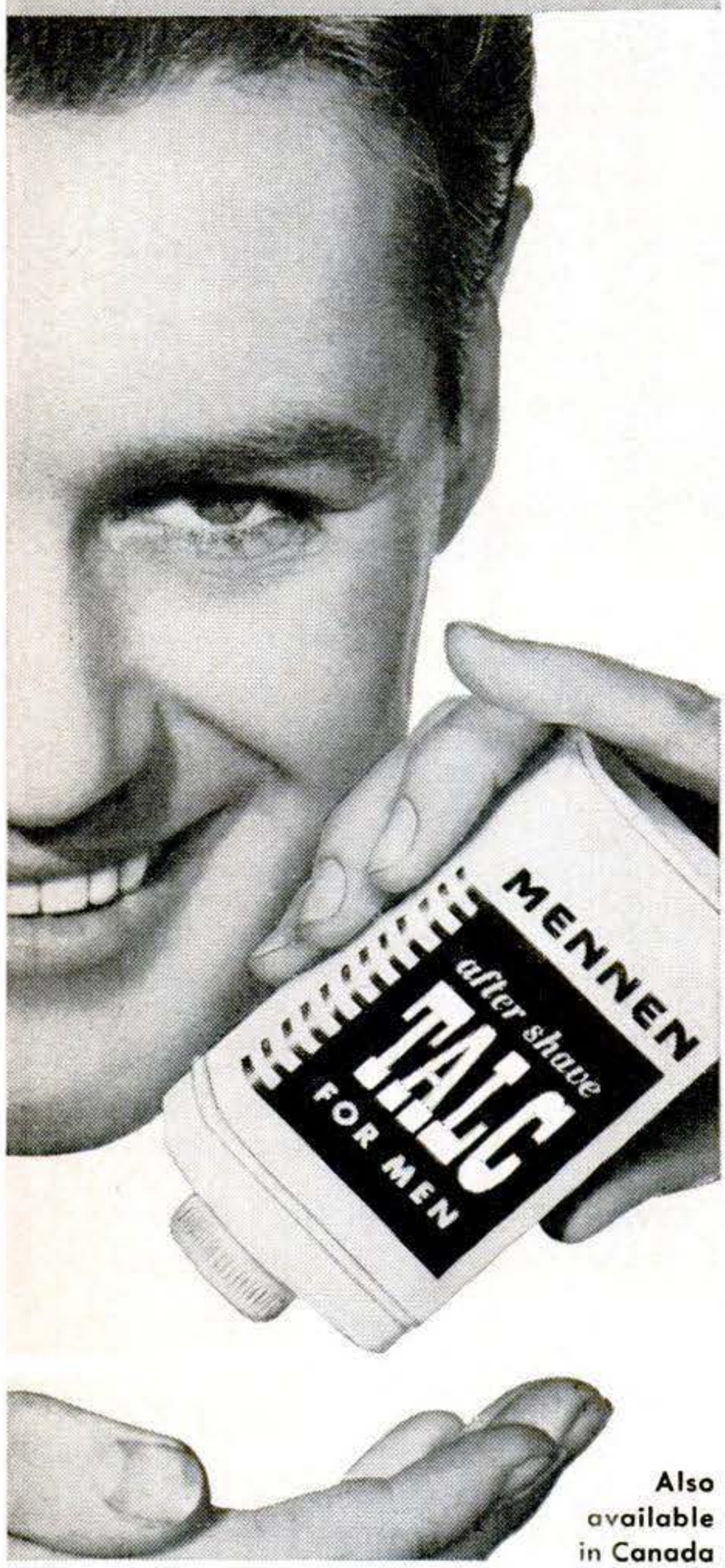

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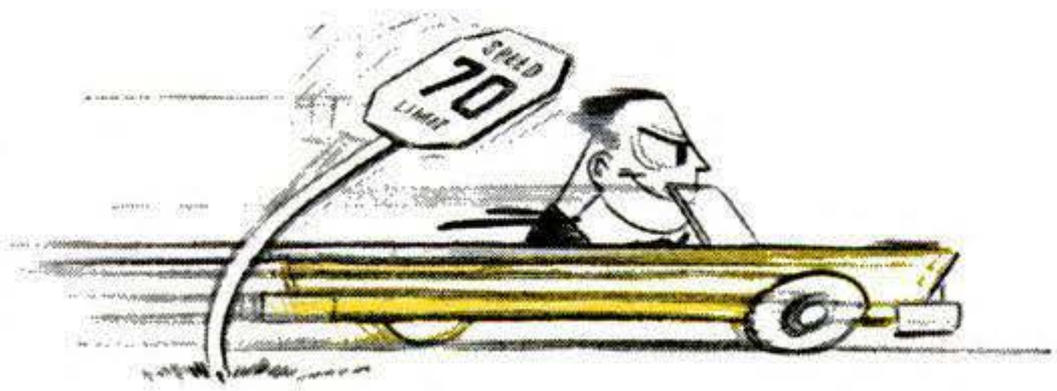
Letters—

Speedometers: Truth vs. Psychology

In the March issue [Letters, p. 14], I read about the controversy over whether or not automobile speedometers should be modified to read no more than 70 m.p.h.

I believe that speedometers should tell the truth; that they should range from zero to the maximum speed, or more, of the vehicle. If a speedometer is limited to a maximum of 70, it becomes an out-and-out liar. We get enough prevarication from other human beings without trying to develop this characteristic in an important mechanical gadget.

More rigid laws concerning driver licens-



ing are needed, but no attempts at psychiatric speedometers, please.

MYRTON P. CARR, Elmira, N.Y.

The meter on some radio-tube testers is scaled into two separate sections. One section reads "good," the other "bad." It doesn't matter how far the pointer reaches into the "bad" section. Whatever the distance, the tube is simply no good and should be discarded.

If speedometers were scaled in a similar fashion, psychology would really play a huge part in safer, saner driving. The "new look" speedometer would register miles per hour up to 70. Then for the remainder of the scale there would be the ominous word "danger" over a red background.

DAVID P. MONHEIMER, Wilson Heights, Ont.

Of more than 200 letters PSM has received about the speedometer controversy, the great majority favor keeping speedom-

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"Am doing Radio and Television Servicing full time. Now have my own shop. I owe my success to N.R.I."—Curtis Stath, Ft. Madison, Iowa.

"Am with WCOC. NRI course can't be beat. No trouble passing 1st class Radio-phone license exam."—Jesse W. Parker, Meridian, Mississippi.

"By the time I graduated I had paid for my course, a car and testing equipment. Can service toughest jobs."—E. J. Streitenberger, New Boston, Ohio.

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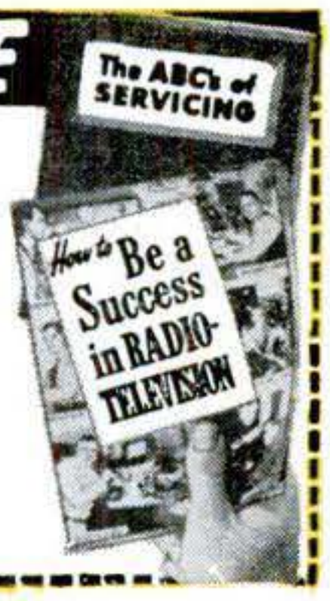

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eters honest. About half are for adding a colored light or buzzer to warn a driver when he goes over some "safe" speed. Several suggest wiring the ignition through the speedometer to cut the motor off at 70.

Water Pistol Guards the Barbecue

We do a lot of back-yard barbecuing and I always had a bottle of water handy to control the flames which spring up from dripping grease. A better method, I found, was to use a 25-cent child's water pistol. When the flames jump up, a well-aimed

squirt puts out the flames without cooling surrounding coals.

MEL BAKULA, Denver

He Made It—but Can't Sell It

I note that Pearl E. Fitzpatrick of Gary, Ind., wants a typewriter eraser with a magnet on one side of the metal center disk so it would stick to the side of a typewriter ["I'd Like to See Them Make," Feb., p. 153].

Several years ago I patented a Magnetic Typewriter Eraser with a disk magnet at the core (U.S. Patent 2,434,973). I have tried to get manufacturers interested—but with little success to date.

RALPH M. WILLIAMS, Wellington, Kan.

Applause for Our Boat Show

Picking up a POPULAR SCIENCE at an El-stop newsstand on my way home from work the other evening, I was impressed again by the thoroughness with which this publication handles an article.

Your "Family Boat Show" [Mar., pp. 154-173] was, I thought, extremely well done.

EDWARD S. SPANKE, Chicago
Outboard Boating Club of America

Better Way to Stow Coffee

In "Hints from the Model Garage" [Mar., p. 250] you recommended screwing an empty oil can to the car floor as a holder for the coffee thermos. I believe it would be simpler to cut a slot in the oil-can bottom to slip over a screw set in the floor. The slot would have one part big enough to go

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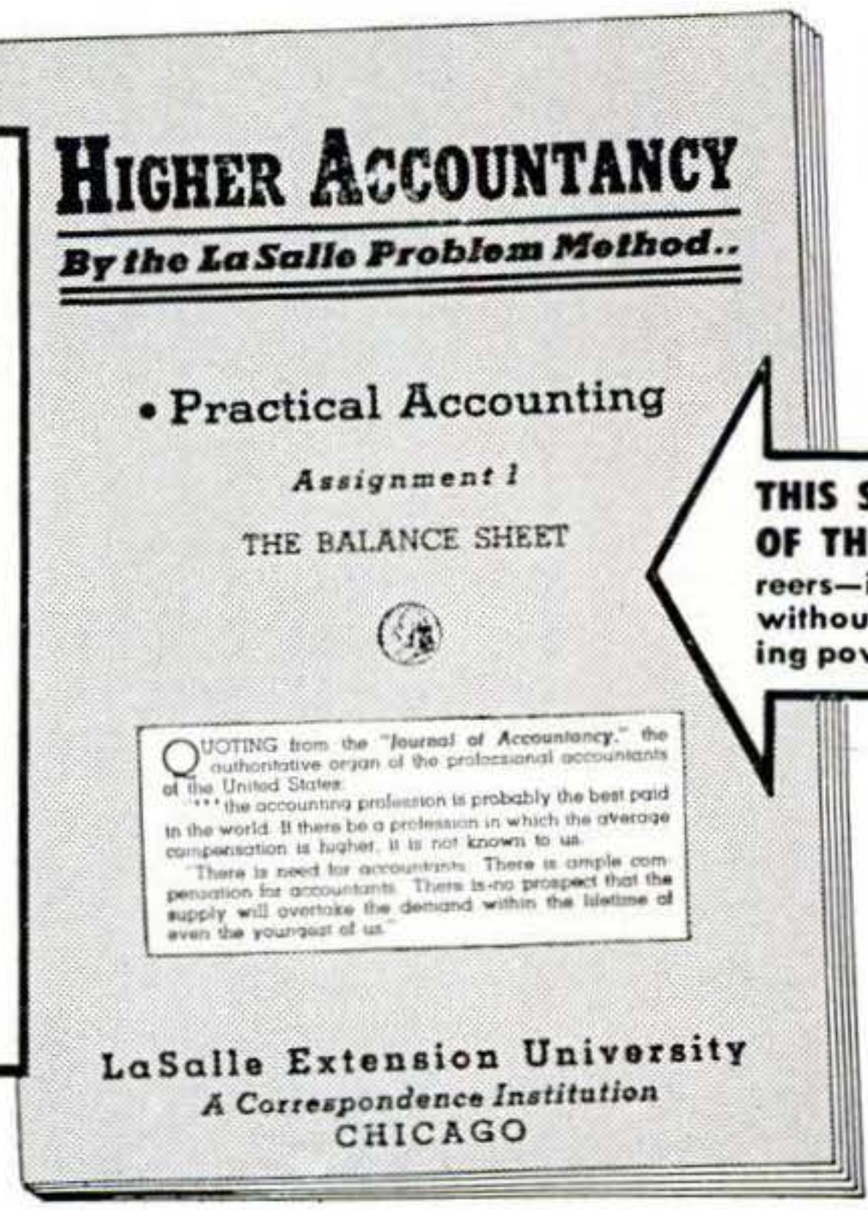

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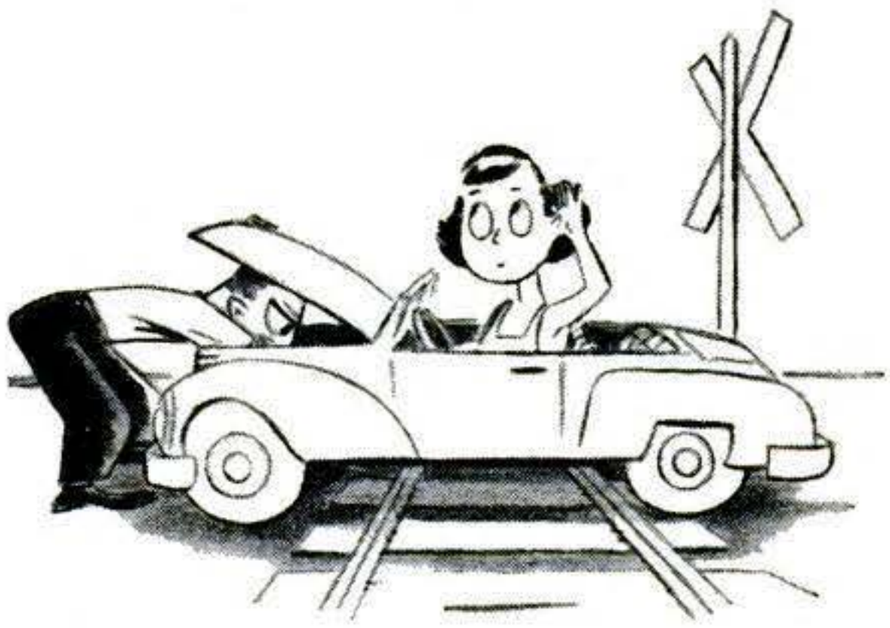
over the screwhead, then narrow to fit snugly around the screw shank. The can could be slipped off the screw when not needed.

RICHARD CAPELLA, Solvay, N.Y.

Trains Whistle a Falling Note

Weren't you off the track on your explanation of the way a train whistle changes pitch as the train speeds by [Dec. '54, p. 146]? As the train approaches you hear a



higher pitch rather than a rising note. And as the train goes away you hear a lower pitch rather than a falling note. The pitch changes as the sound emitter passes. It is fixed pitch except at the passing point.

H. D. SANBORN, Wheaton, Ill.

That is true only if you stand where the train would run over you. The change in pitch depends on the train's speed toward you. *Since you stand to one side of the tracks, the train's speed toward you is constantly decreasing. That means you always hear a falling note. You first hear the whistle's pitch higher than its true value. It descends to the true value as it passes you and continues to fall below the true value as it goes away.*

Why Not a Safety Race?

Your Kenneth Wylie, Devon Francis and Frank Rowsome Jr., [April, pp. 122, 128, 131] are all excited about horsepower, acceleration and top speed. Three very interesting articles, too, and the boys can't be criticized for being excited with their experiences. A ride in that Cramer Comet would be something special, driving the Chrysler 300 is thrilling and anything they put on at Daytona Beach is well worth attending.

But what good is all this extra power? Why pay for a possible 112.131 m.p.h. in a Chevvy when anything over 60 is in violation of the law and many of the roads avail-

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able automatically discourage illegal speeds? A safe margin of surplus power for emergencies, yes. But why such extremes?

These horsepower boys must be good to achieve the results they have. Why not divert some of this talent to an economy program? Lack of comfort limits the midget car as an answer, but there is a solution somewhere, and the same effort and publicity that produced such advances in power should develop tremendous results for economy and safety, if so applied.

LEE HANSON, Sioux Falls, S.D.

An Old American Custom

Do people still call their cars names [Letters, Dec. '54]? We live where we have to have a jeep to take our children to school and I think I can answer your question. Yes, people still call their cars names. But as you

probably wouldn't print it anyway, I will refrain from telling you what we call ours.

R. WEATHERILL, Branscomb, Calif.

Primer-Sealer Is Not Sealer-Coater

In the February issue [p. 101] I found a statement that could be responsible for some trouble. You said: "Definitely good inside the house is a new vinyl primer-sealer (Du Pont) to be used as a base coat under any paint. It dries in as little as 30 minutes."

Du Pont *primer-sealer* is not a vinyl product—nor will it dry in 30 minutes. Du Pont *sealer-coater* is a product containing a vinyl emulsion. It can be reduced with water and will dry in from 30 minutes to two hours.

These are two different products.

R. G. ALLENBACH, Galion, Ohio

He Thought of It First

That suggestion about a horizontal nail set ["I'd Like to See Them Make," Jan., p. 165] interested me because I have a patent on this very thing. The tapered-bit portion can also be made to serve as a center punch. I am firmly convinced after 25 years of carpentry work that there is a market for a tool like this.

LOUIS J. DIPIETRO, Waterbury, Conn.

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INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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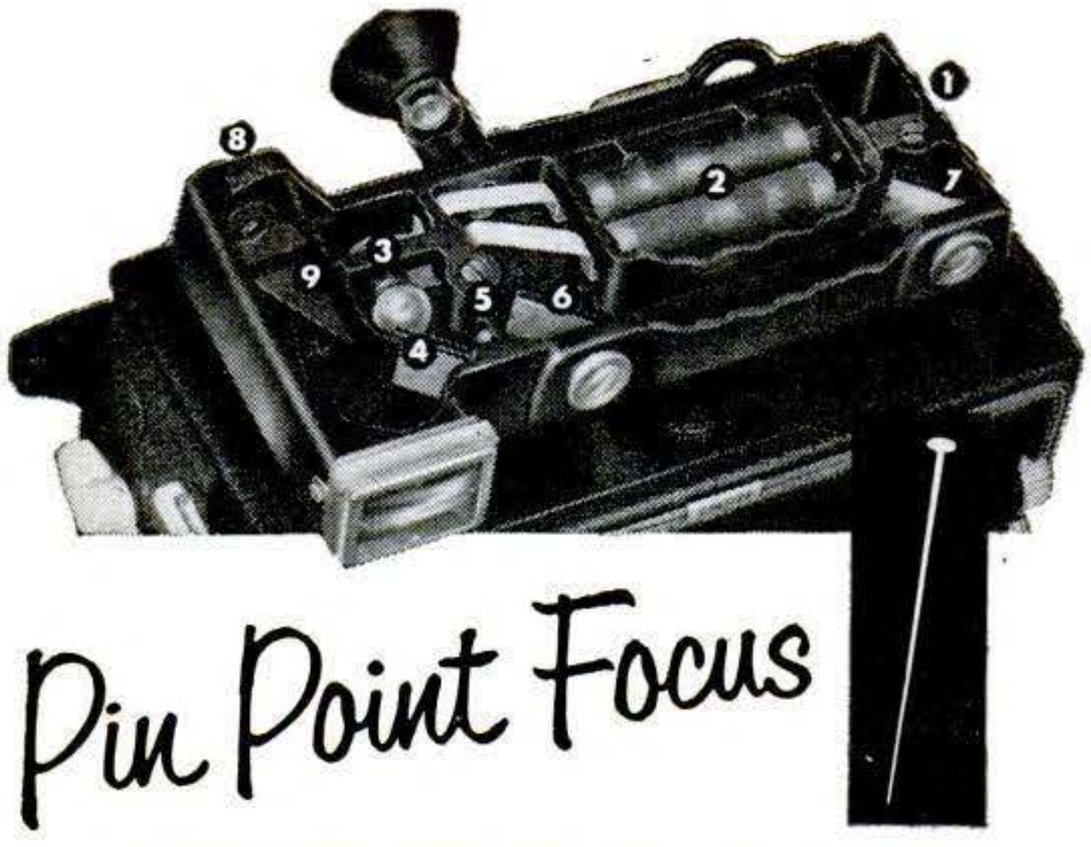

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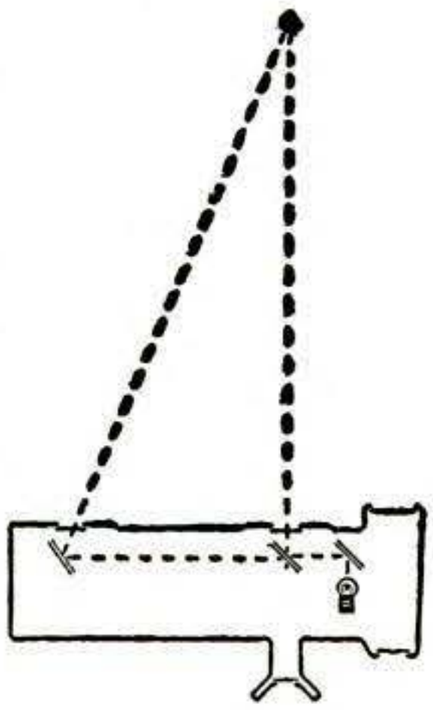

Here's the way it works. Referring to the illustration above, the push-button switch (1) connects batteries (2) to lamp (3). Beam of light is reflected by mirror (4) through lens (5) onto beam-splitting mirror (6). Part of light is deflected at right angle onto subject, rest passes through glass to movable mirror (7) which is connected to camera focusing mechanism. As camera is focused, this mirror moves, directing a second beam of light onto the subject. When camera is exactly focused, both beams of light are superimposed. Simultaneously, parallax is automatically corrected on the optical viewfinder (8) through linkage (9).

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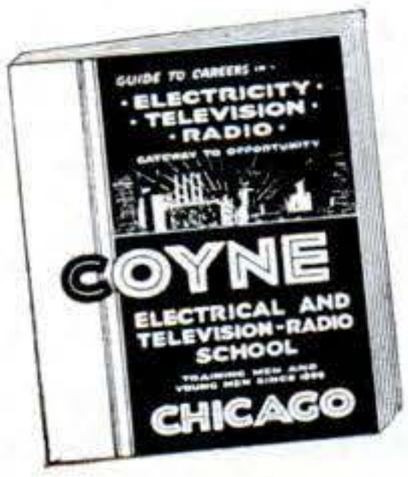

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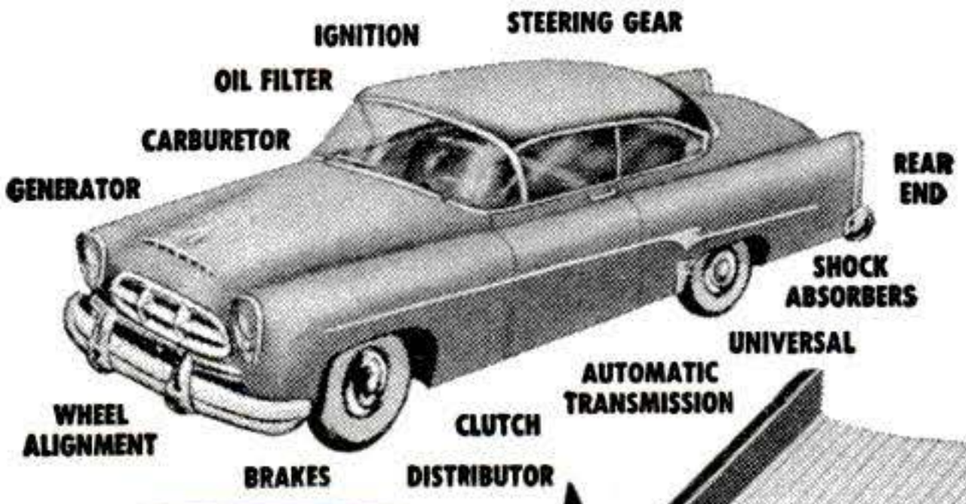

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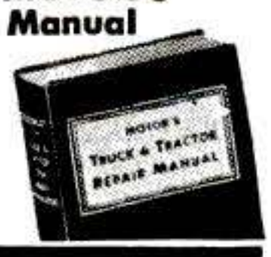

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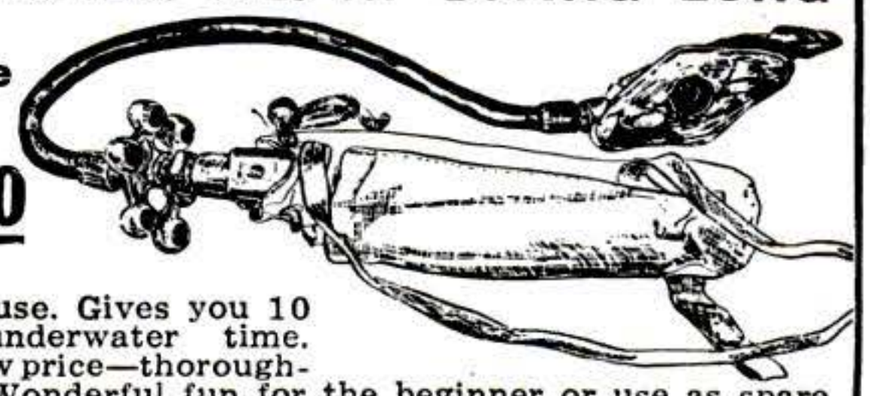

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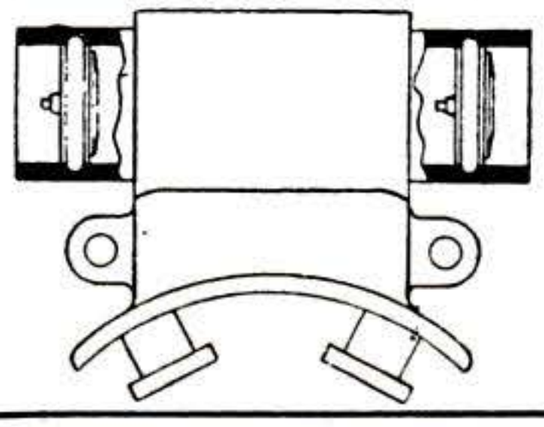

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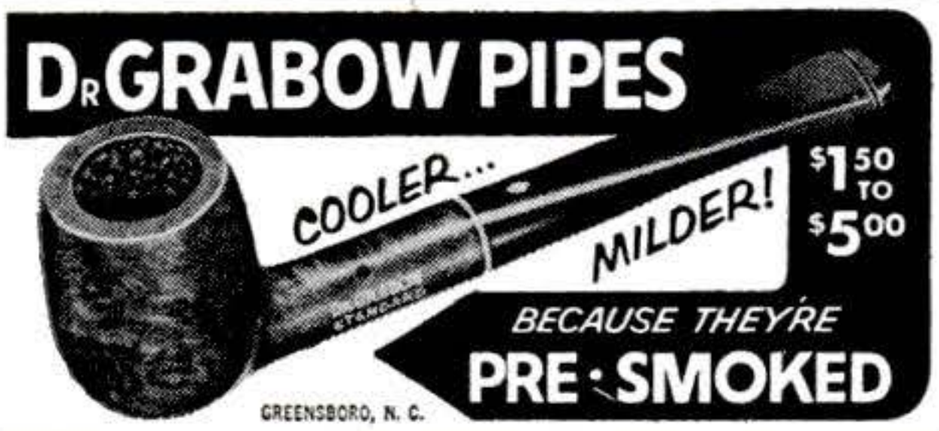

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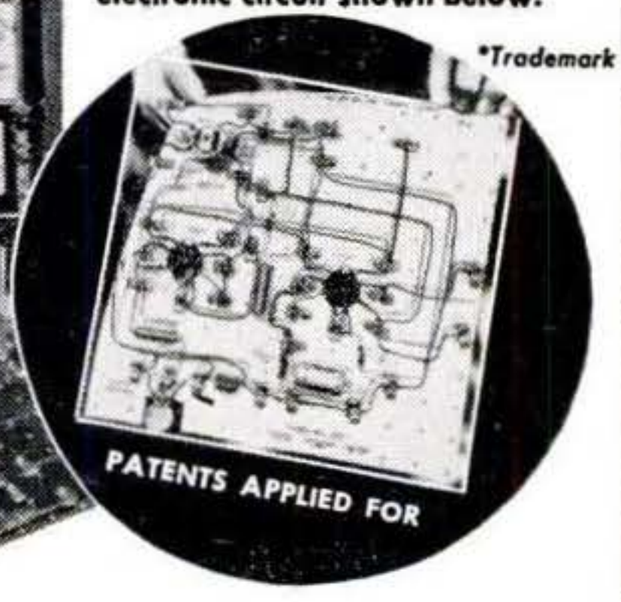

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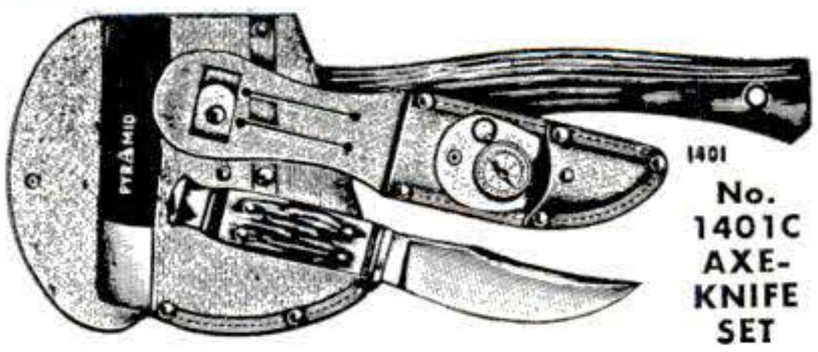

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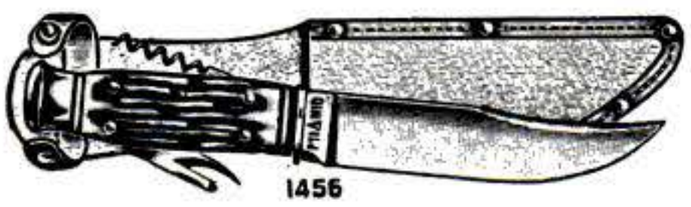

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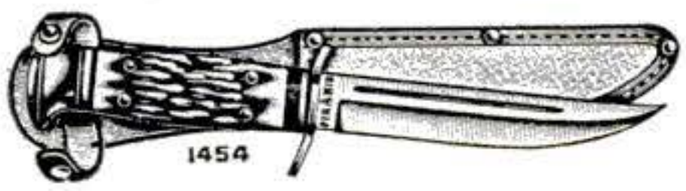

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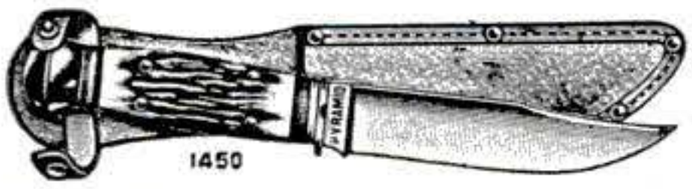

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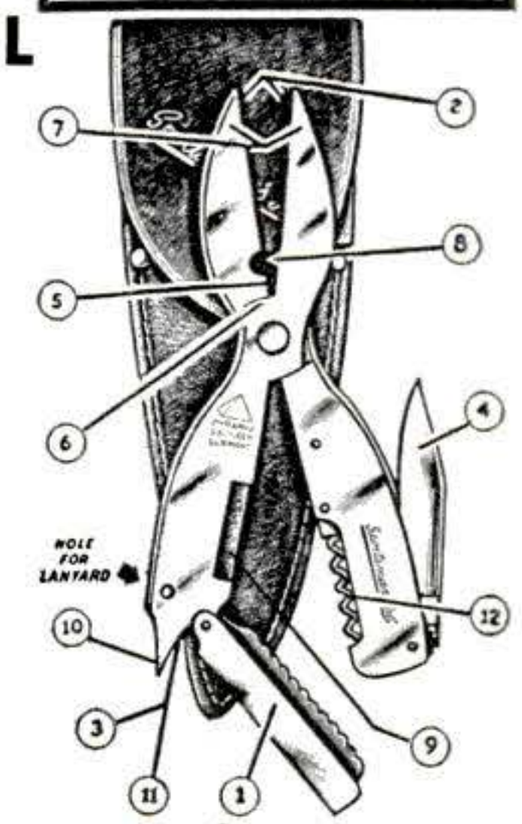

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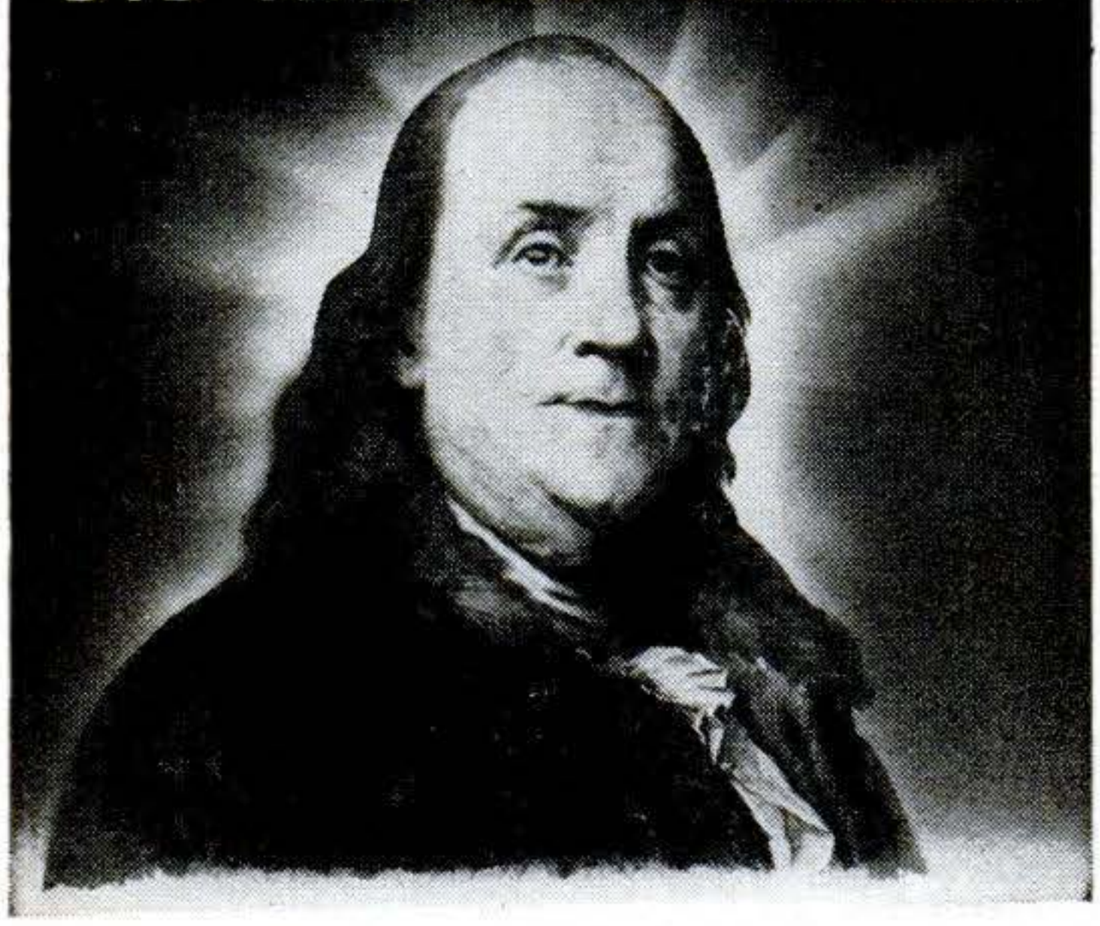

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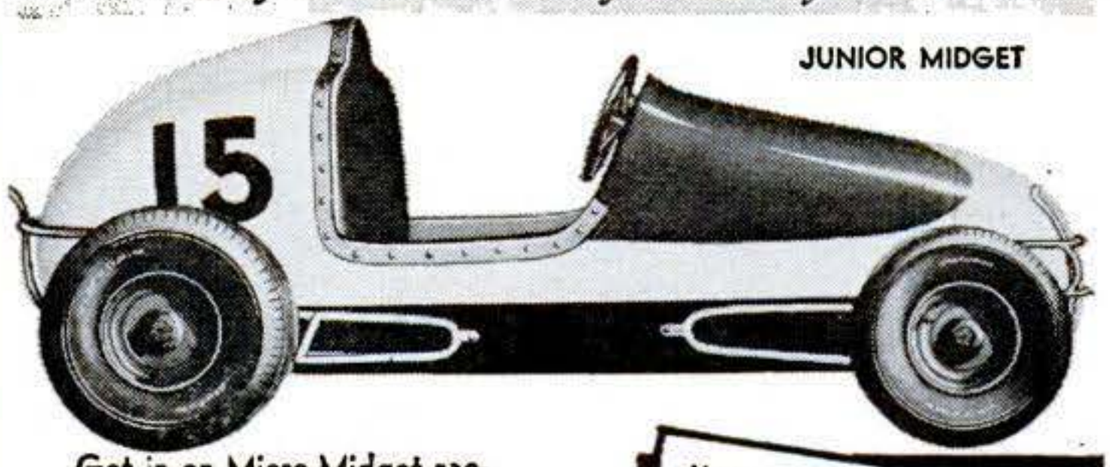

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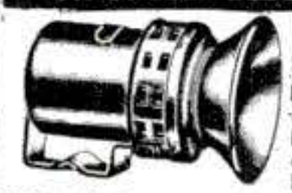

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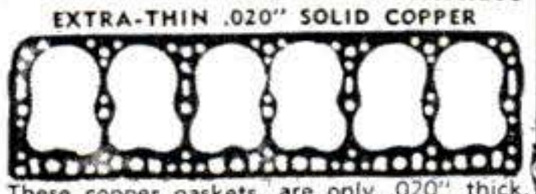

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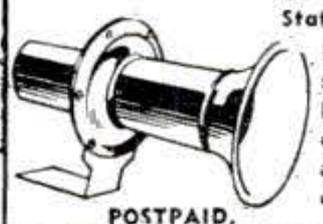

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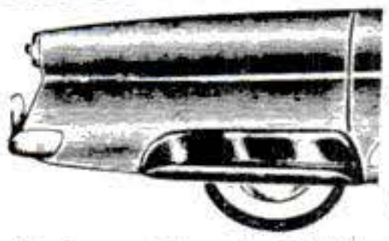

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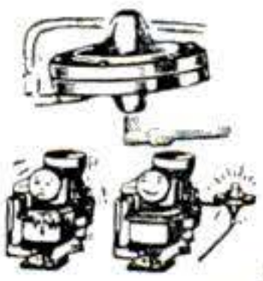

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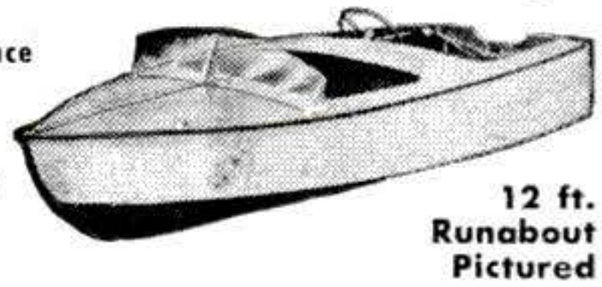

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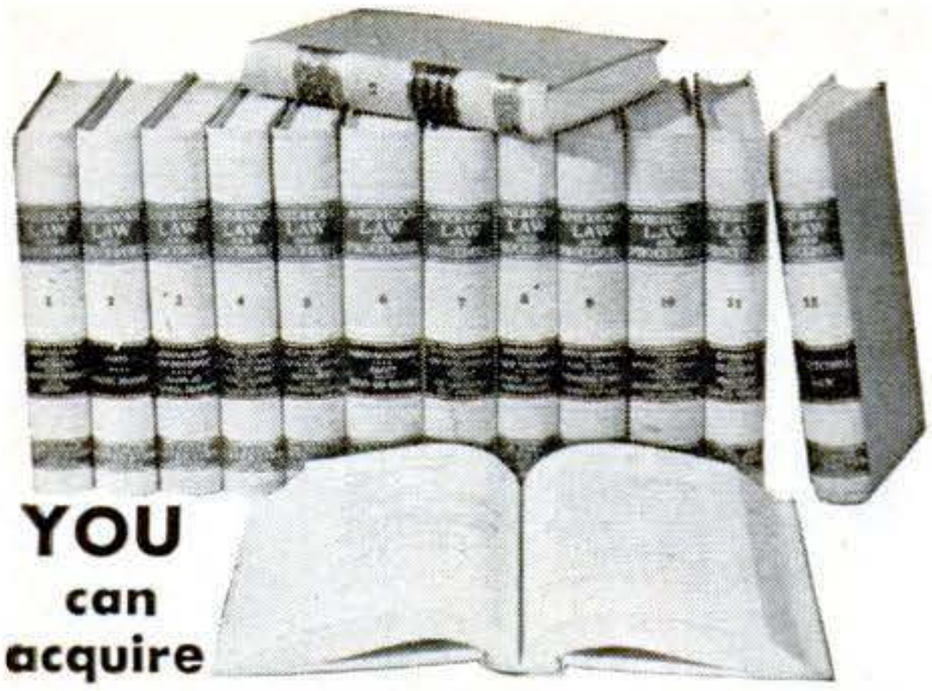

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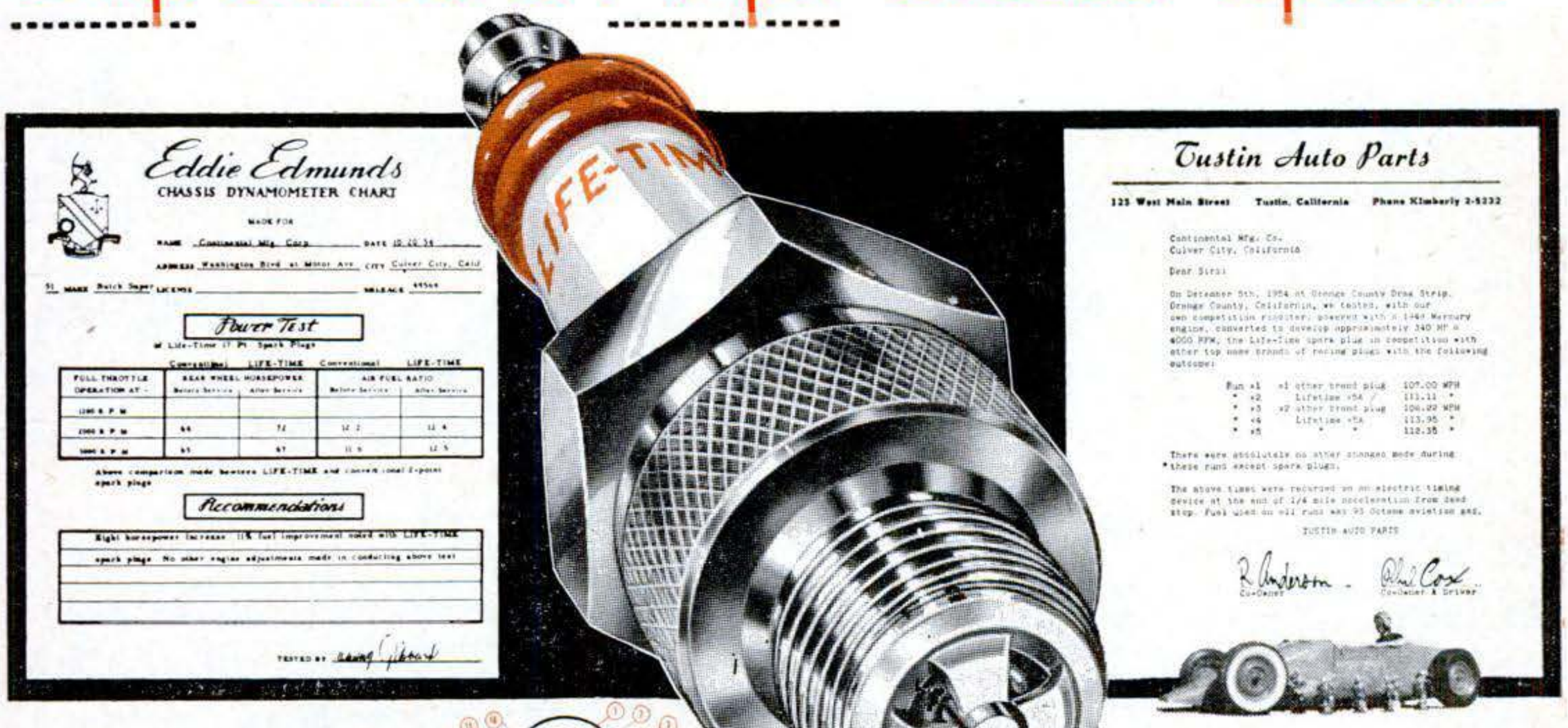

HOW 17 PT. FIRING WORKS

Note electrodes closely A circular arcing area (four concave segments). Gap being the same from all points. Electricity has property of arcing from coldest point Current also arcs more readily from apex of two planes than from the face of a flat, metallic surface

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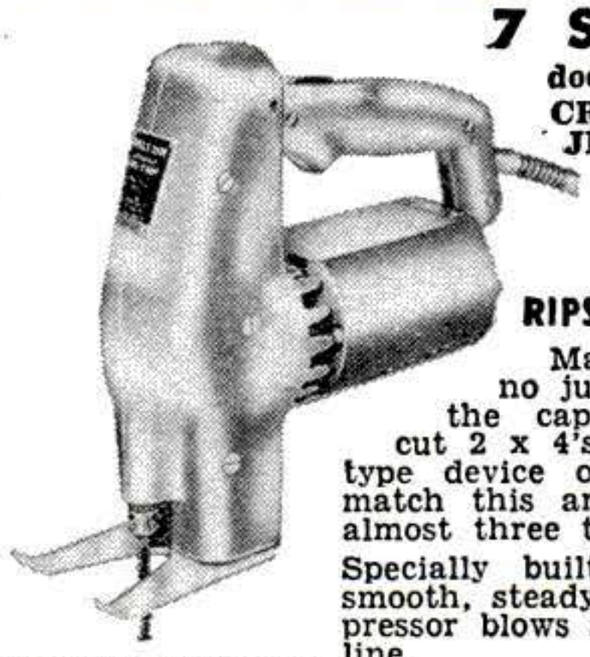

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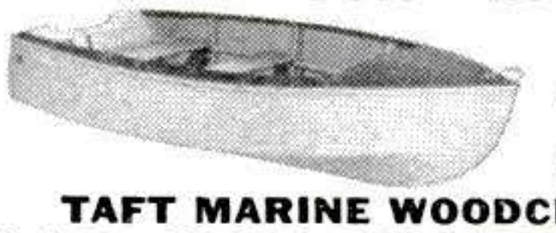

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650-16 (6)	6.65	710-15	5.55	750-17	10.35	825-20	18.95
700-16	6.05	760-15	5.85	825-15	12.95	900-20	17.95
750-16(6)	7.55	800-15	5.95	600-20	9.05	1000-20	17.95
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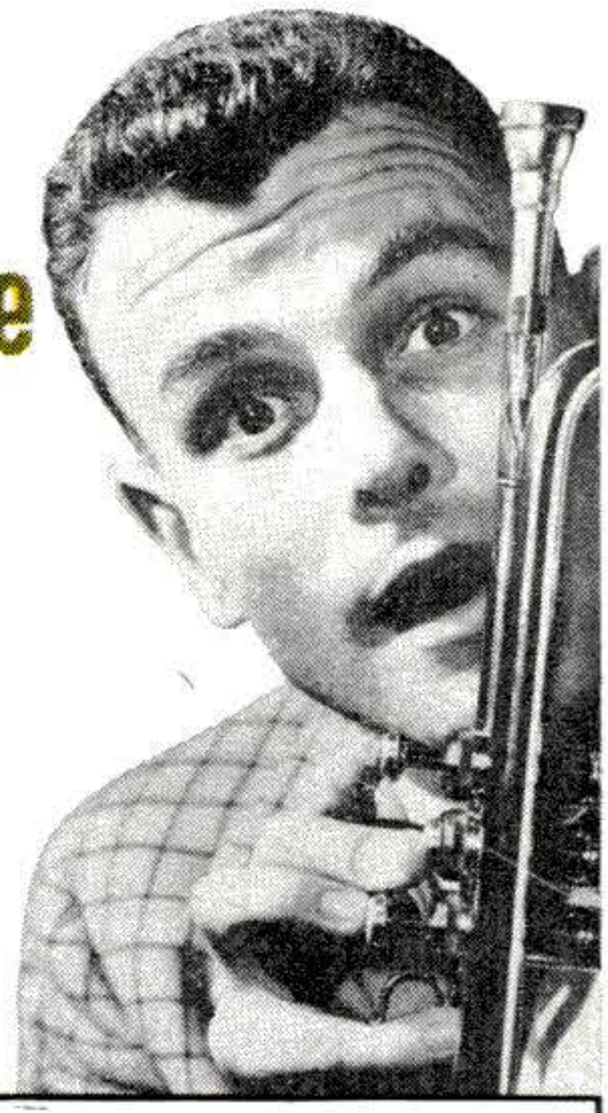

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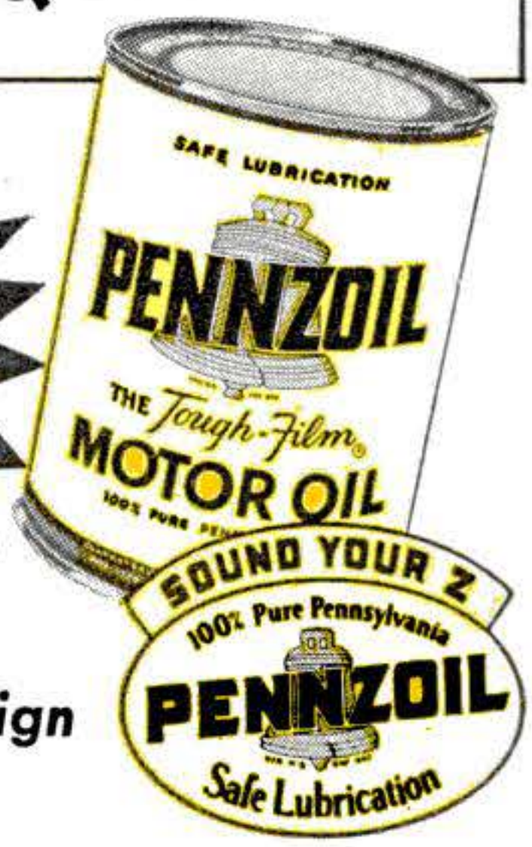

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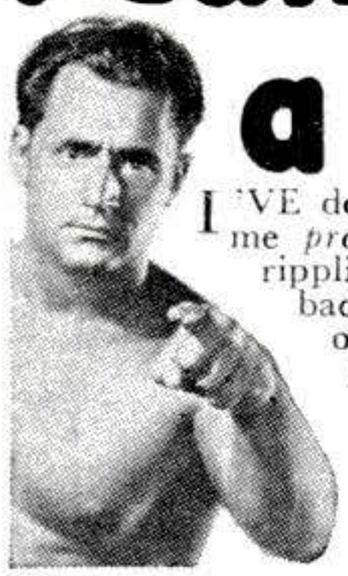

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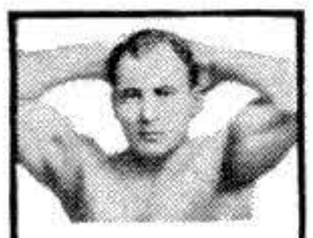

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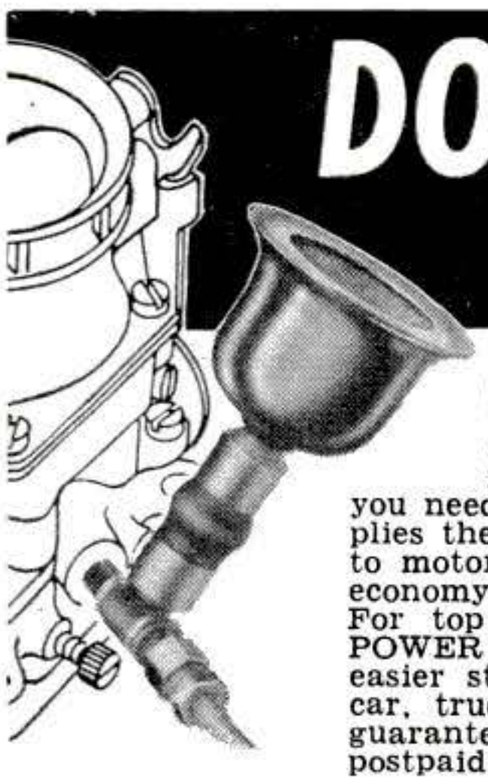

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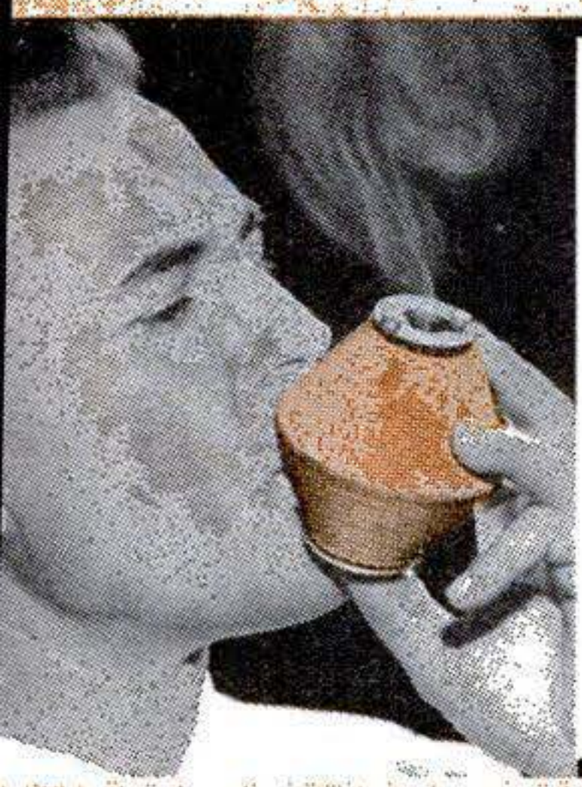

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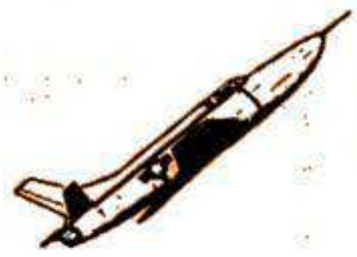

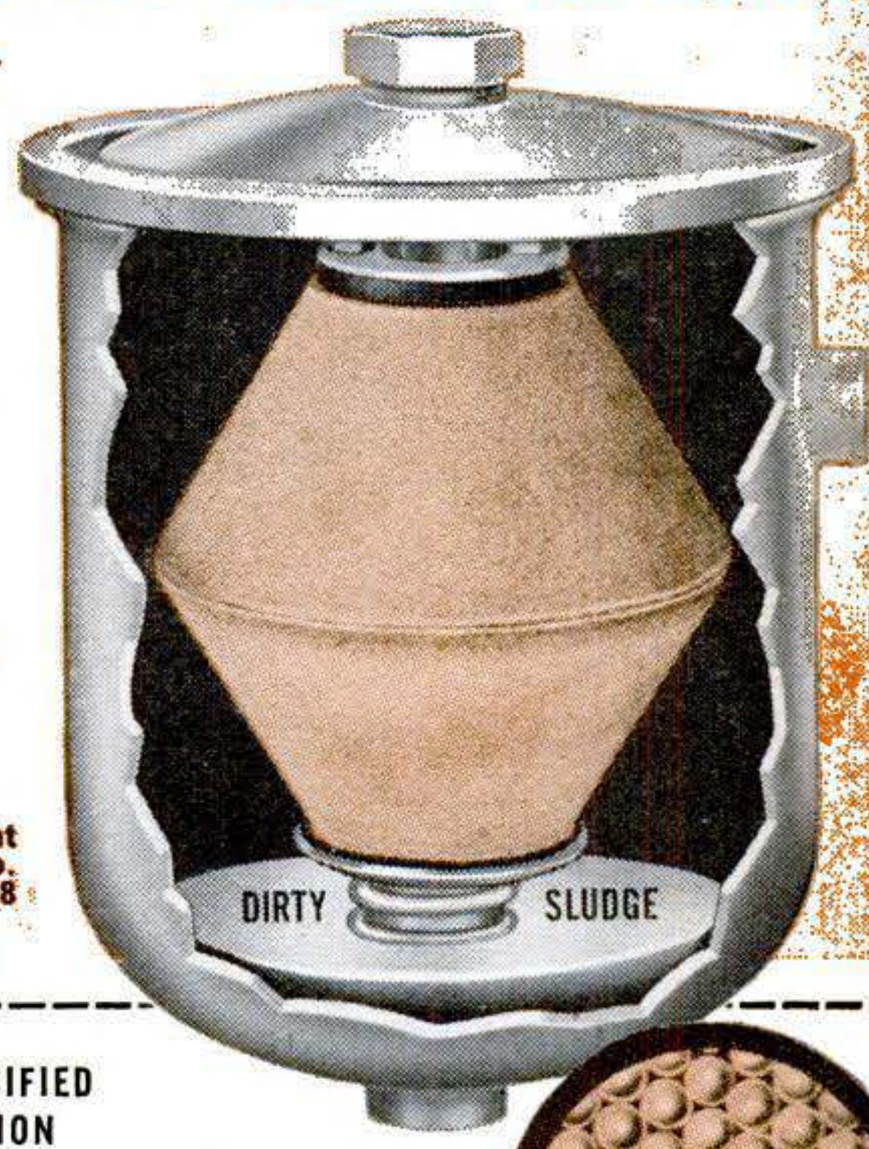

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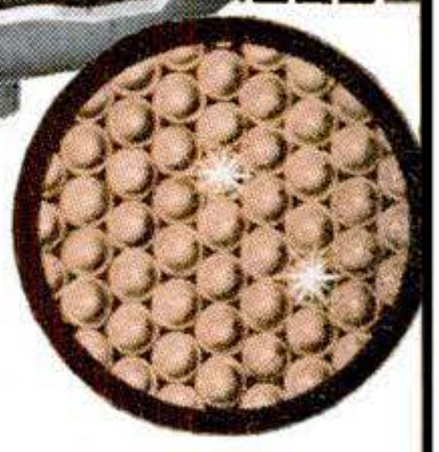
of MICRO BRONZE filter showing microscopic metal balls fused together to make a solid, but porous, filter. MICRO BRONZE metal can't absorb additives, can't "channel," can't "blow," yet screens out finest particles of grit and metal which drop to bottom of filter housing as "sludge."



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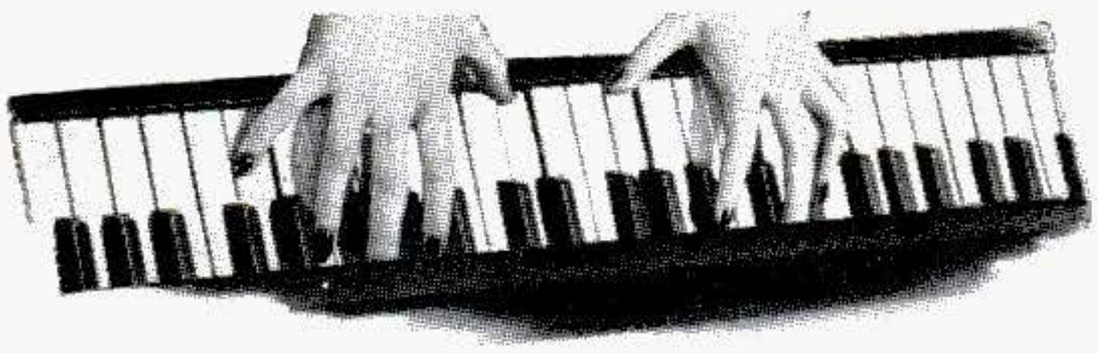

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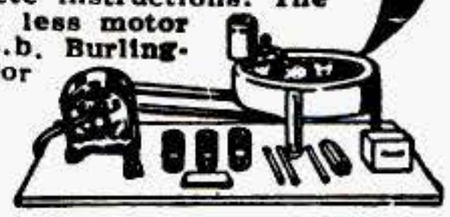

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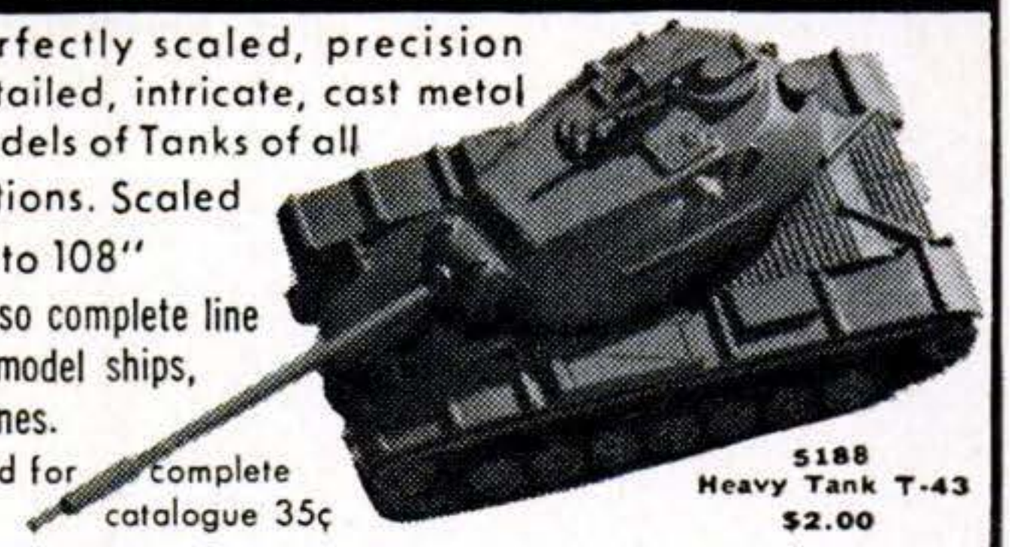

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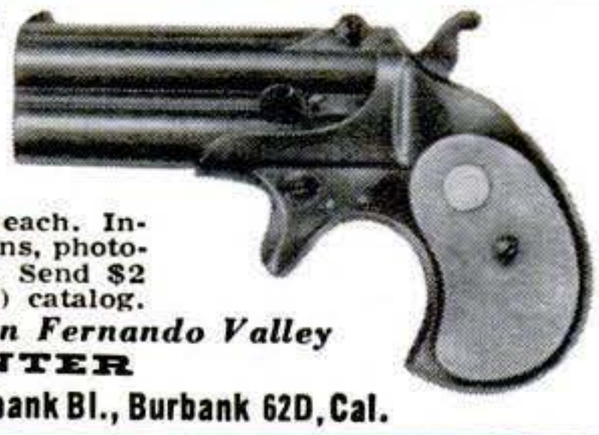

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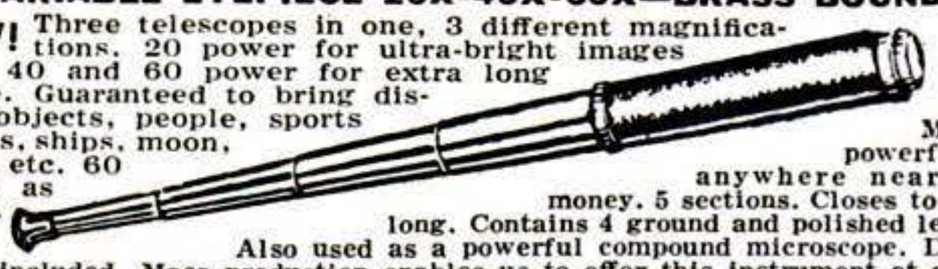

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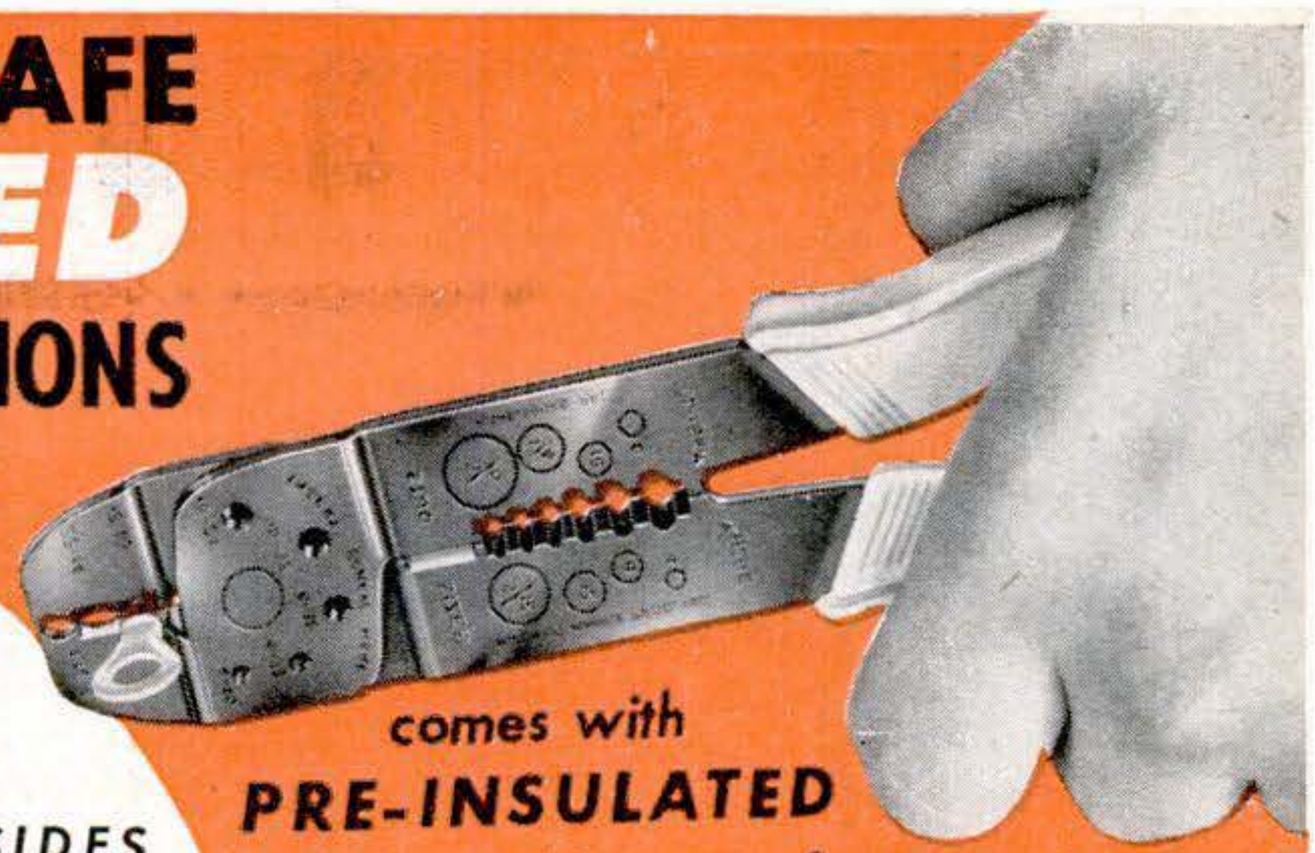

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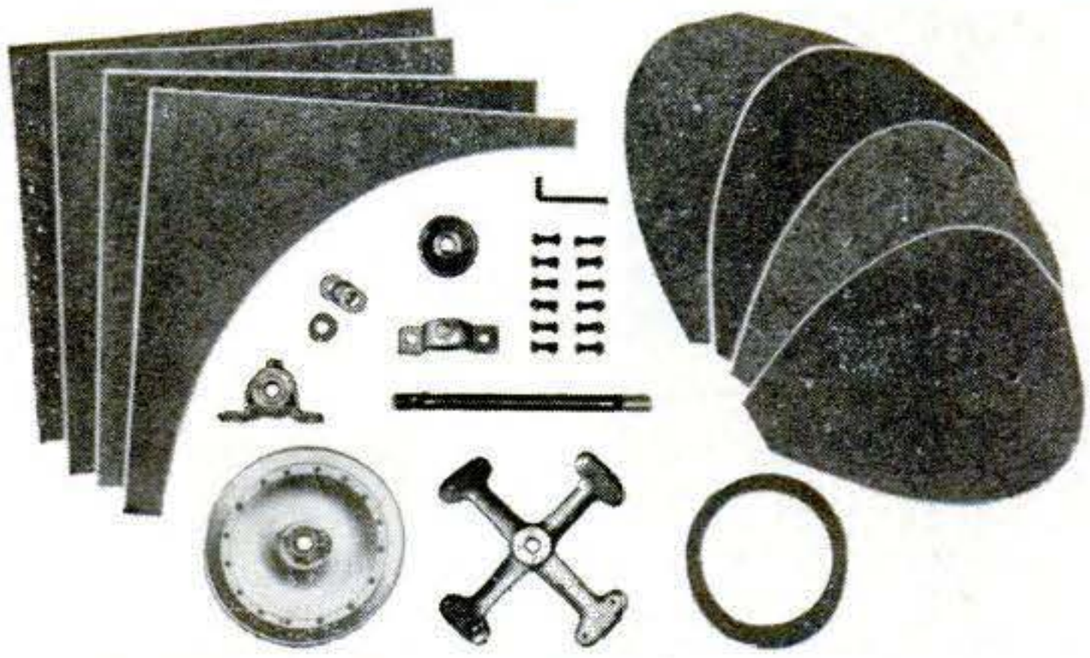

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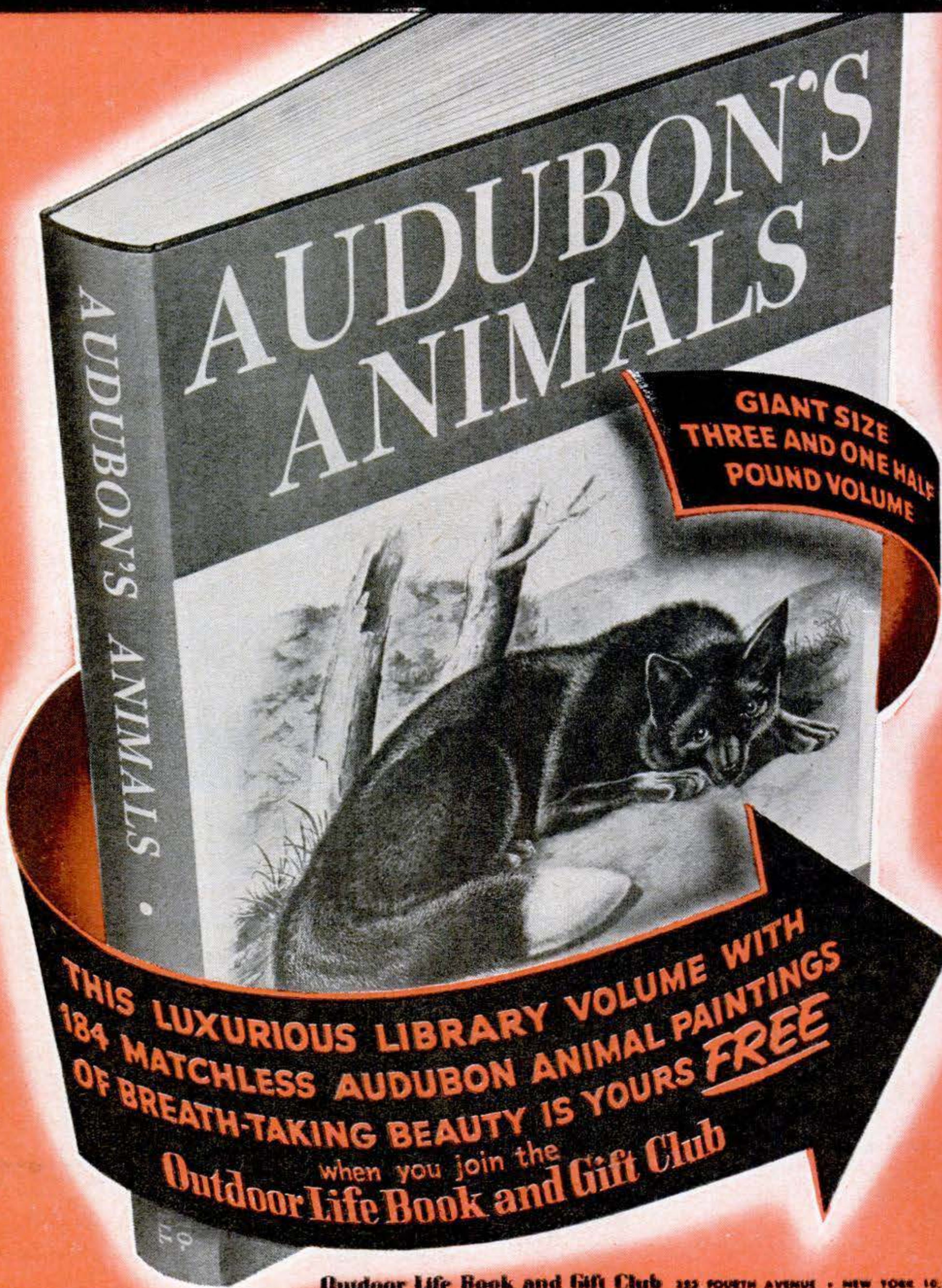

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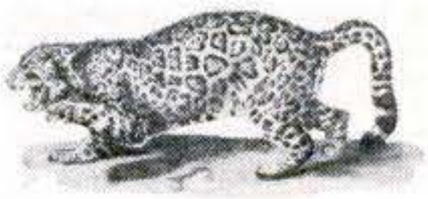

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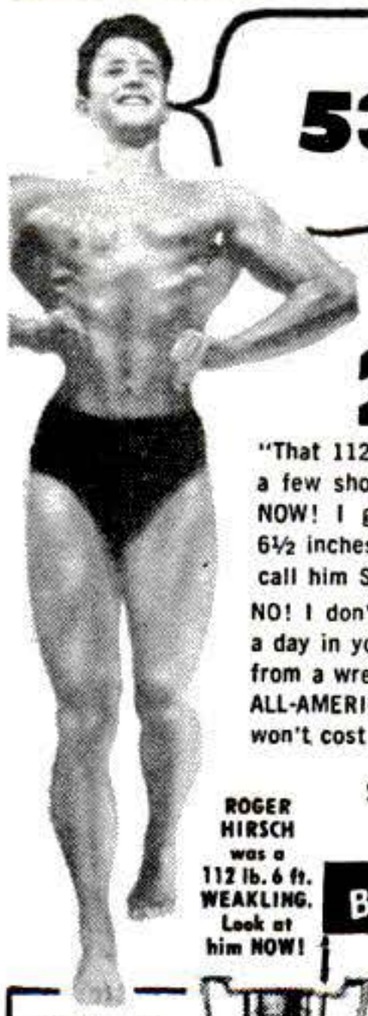

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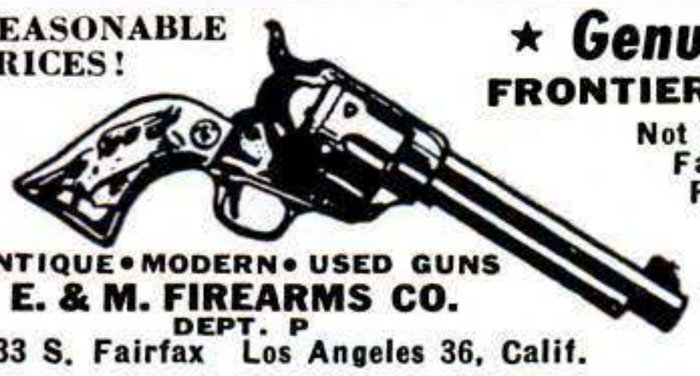

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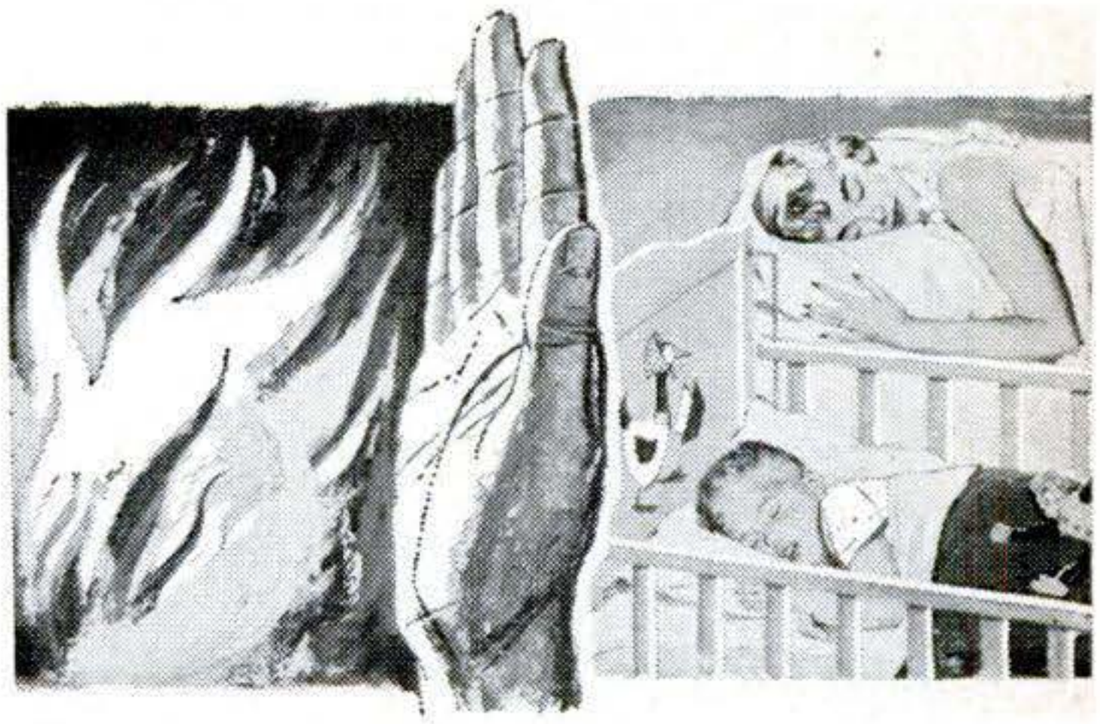

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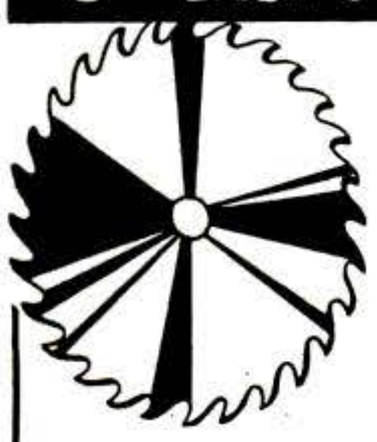

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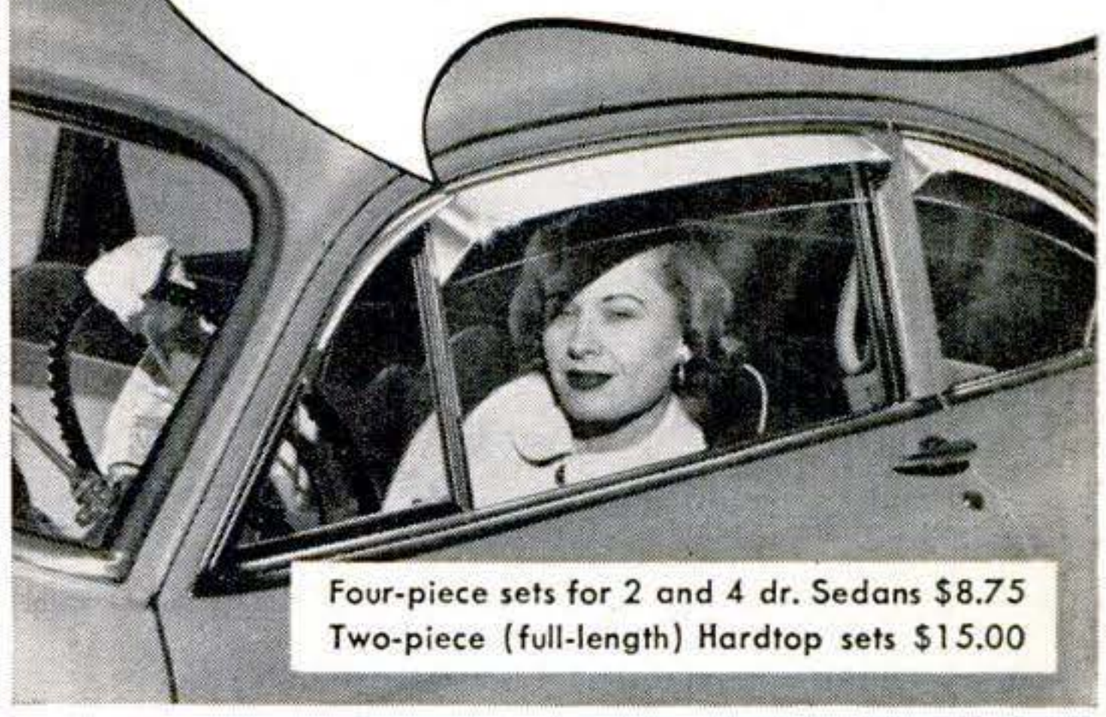

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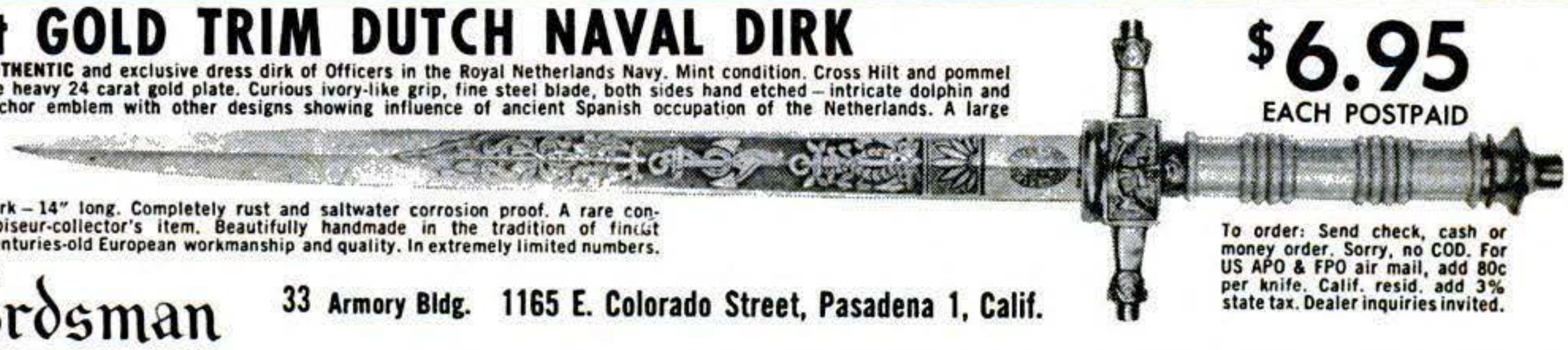

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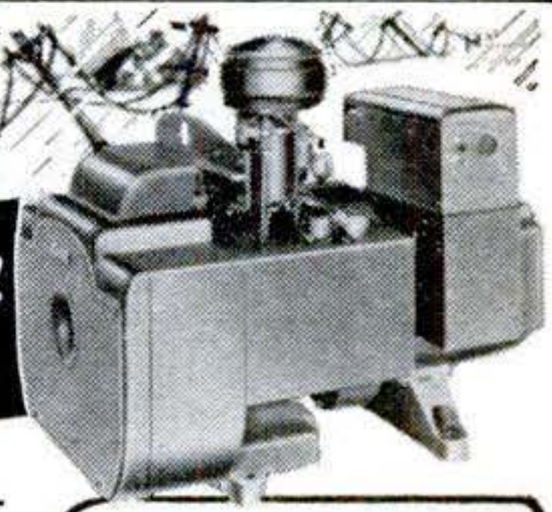

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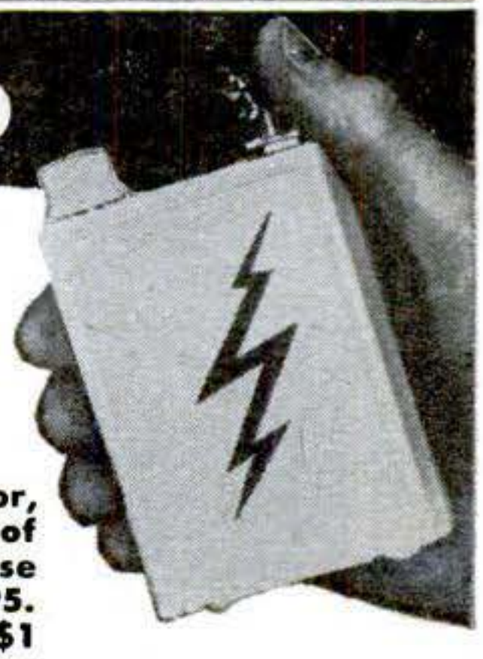

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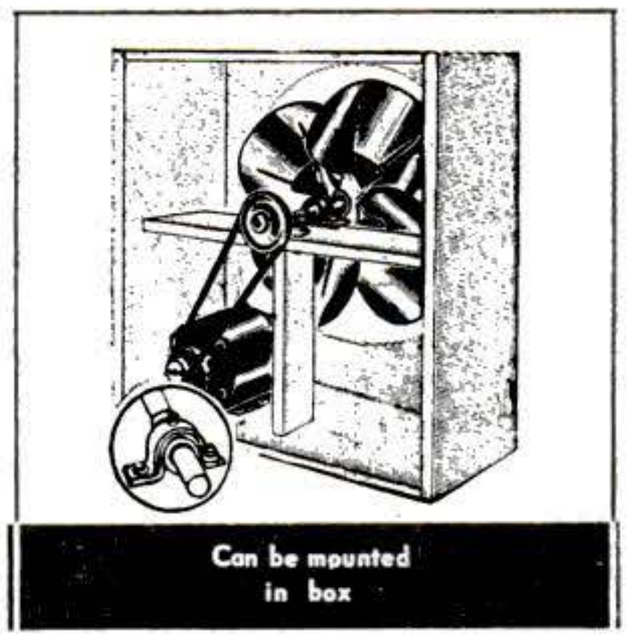

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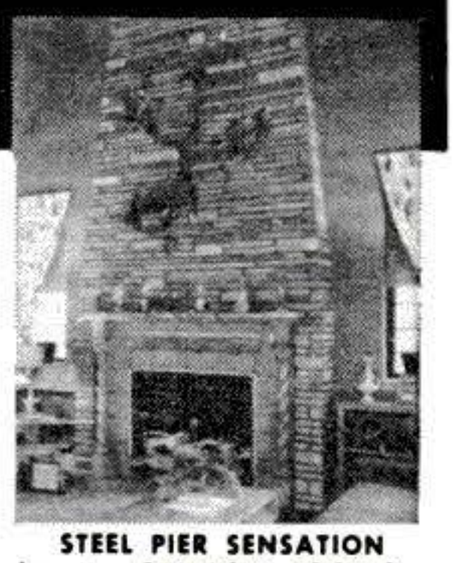

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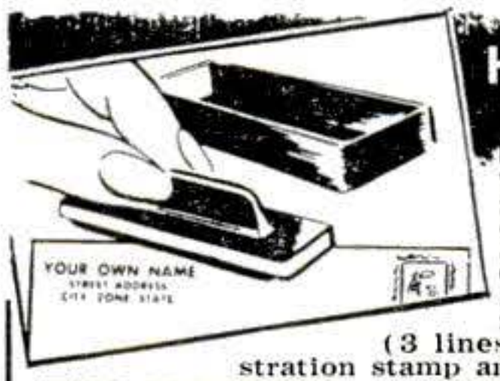

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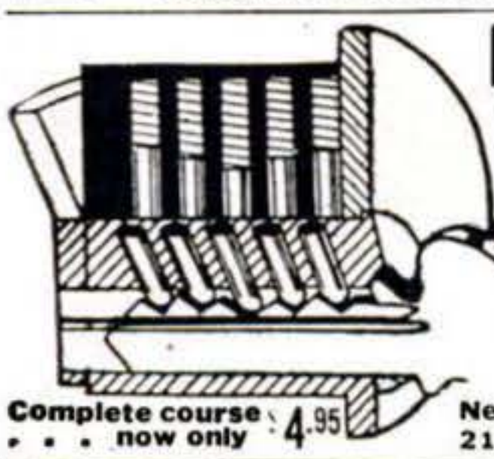

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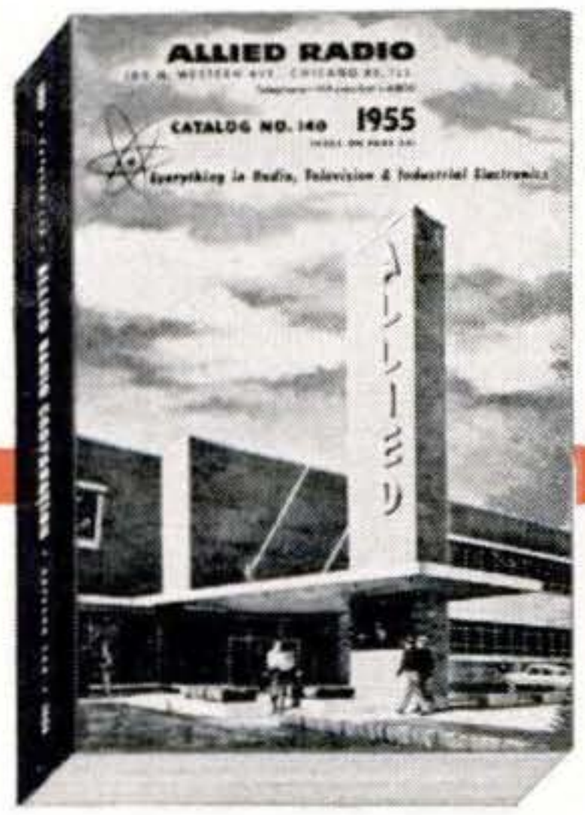

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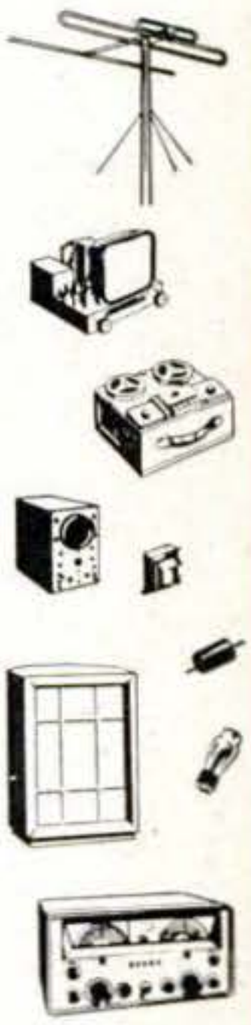

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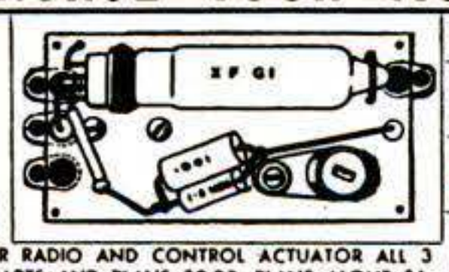

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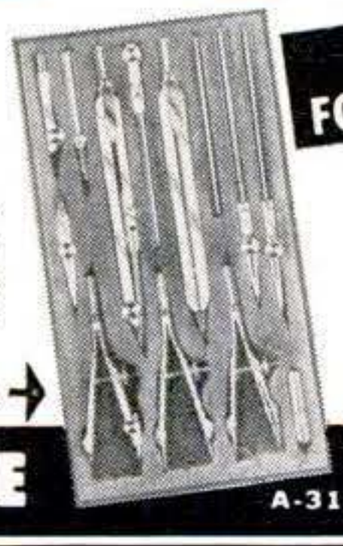

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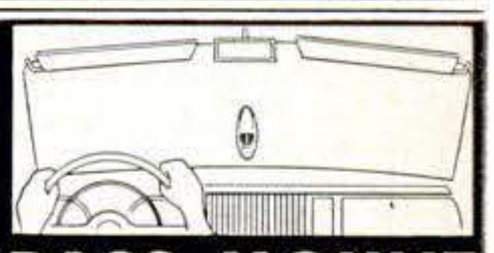

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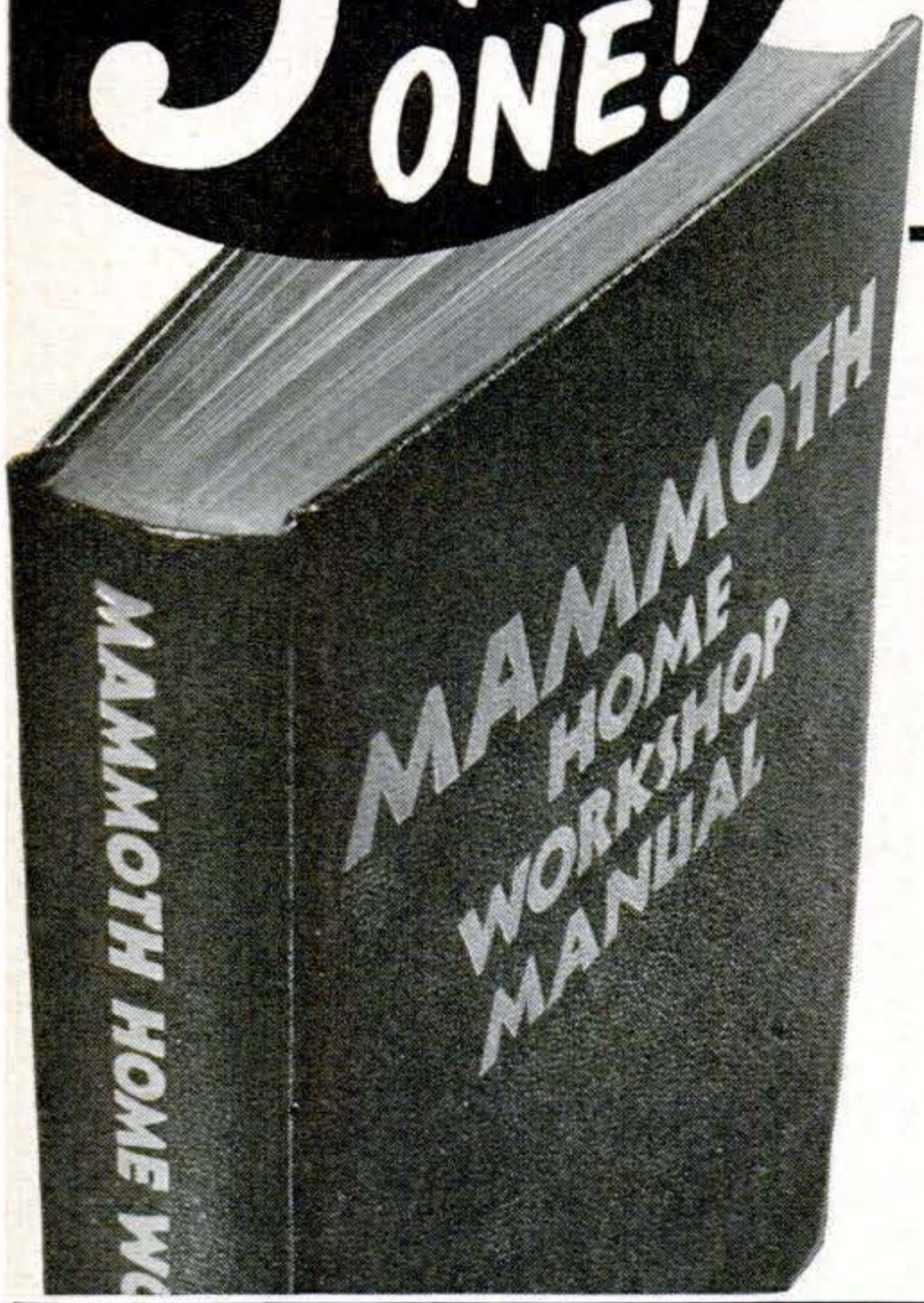

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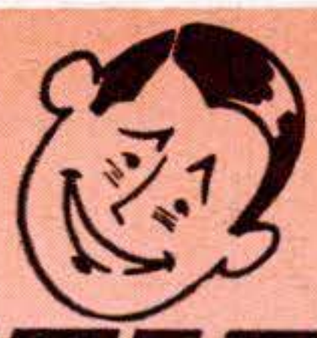

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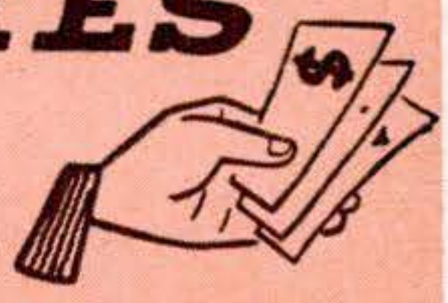

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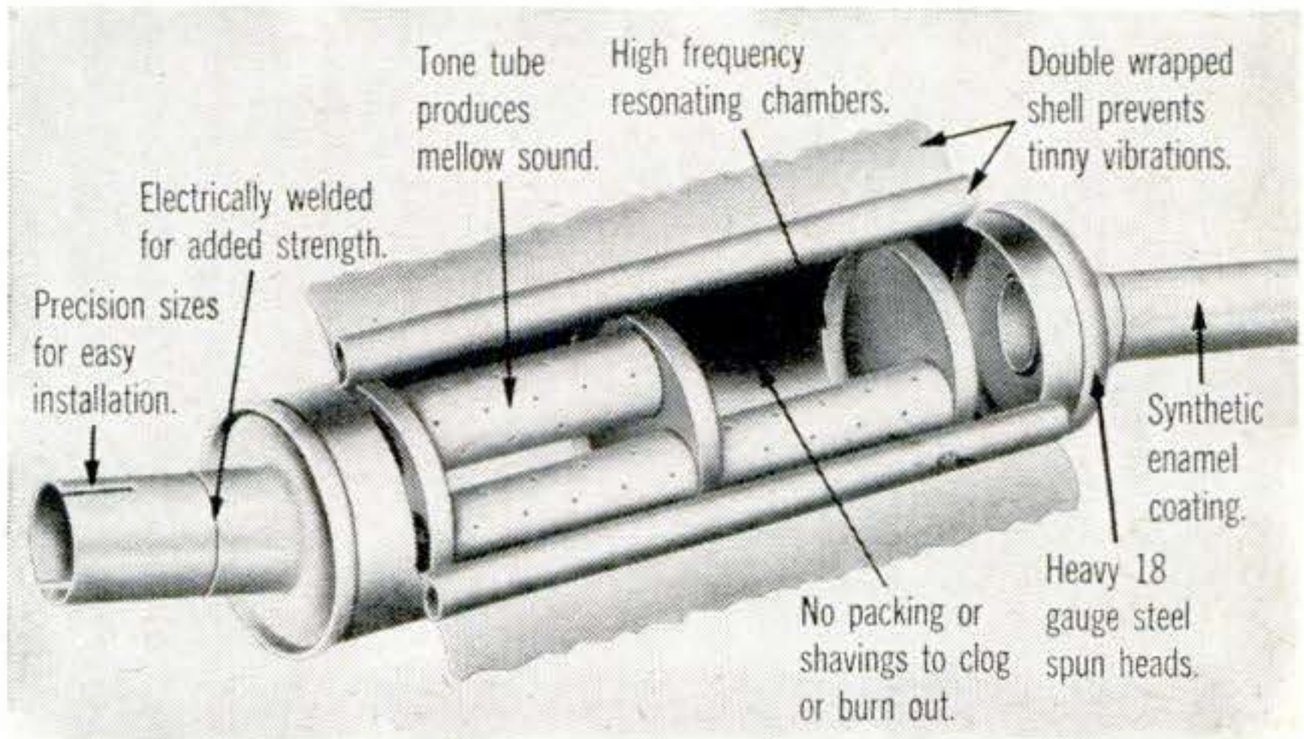

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☆ **Smoother Idling**

☆ **Faster Pickup**

70,000 Miles Without an Overhaul

...from any make, any model, any year car!

A few months ago, a fleet of test cars pulled off the proving ground track and into the shops of one of the largest automobile manufacturers in the world. Outwardly, these cars still looked identical after their endurance runs. Then the mechanics tore down the engines and miked the bearings, rings and pistons. Most of them were ready for overhaul. But some of them *still had three more lifetimes to run!*

Special lubricants? They were all using oil you could buy anywhere for about 40¢ a quart.

The secret? Better oil filtration. Here's why: the moving parts in your engine never touch each other. They're always separated by a thin film of oil. Keep abrasives from getting into that film of oil and, *theoretically*, your engine should never wear out.

Today, the development of two inventions makes it possible for any engine to approach the life and performance that engineers know is theoretically possible. Here are the two inventions:

One is a $3.95 Fuel Monitor designed to improve carburetion and remove gasoline impurities that cause rough idling, loss of power and loss of economy.

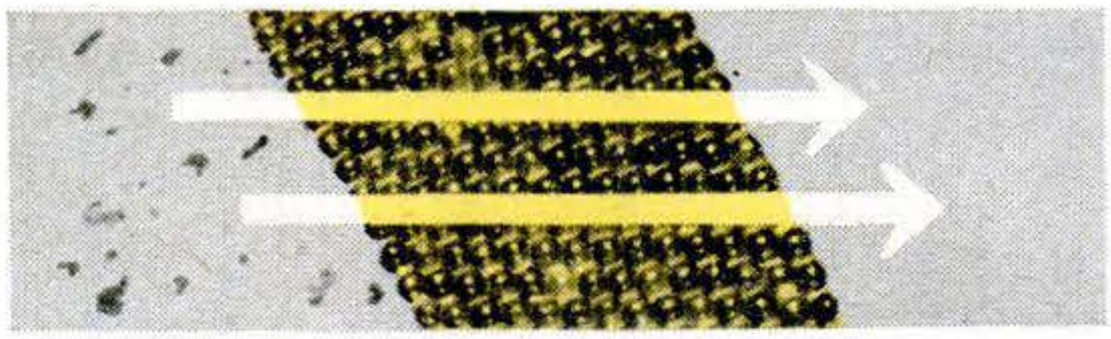
The other is a revolutionary anti-acid, anti-friction Life-Time oil filter which has already increased engine life to 250,000 miles in highway tests.

Both of these inventions are possible only because of the discovery of an amazing metal—sintered bronze.

What is Sintered Bronze and What Good is it?

We make sintered, or porous, bronze by fusing together millions of tiny bronze balls under heat and pressure. The result is an extremely fine screen—much finer than any screen that could be woven of metal or even cloth.

Originally, sintered bronze was used mainly to filter liquid oxygen and other extremely cold rocket and jet fuels, plus superheated gases.



Carbon and abrasives can't get through spaces between bronze balls; oil stays dark, proving no additives have been removed.

Our engineers used this experience to pioneer the development of the Life-Time* automotive filter you have read articles about in magazines like this one.

The Life-Time Fuel Monitor: How it Works

If you've ever dropped a lighted match into a pail of gasoline, you know that *gasoline won't explode.* Only gasoline *vapor* will explode. The more raw, unvaporized gasoline your carburetor delivers to the cylinders, the more gas you waste. The more highly vaporized a mixture your carburetor puts out, the more mileage and power you get from your gasoline.

Increased Vaporization

Most improved carburetors try to increase vaporization by doing something to the gasoline *inside* the carburetor. The *Life*-Time Fuel Monitor simply tackles the same problem in a different way *before* the gasoline gets to the carburetor. Attached to your carburetor just like an ordinary gas filter, the *Life*-Time Fuel Monitor has a porous bronze element which:

(1) removes water from gasoline, plus tiny amounts of low-volatility petroleum tars which interfere with complete vaporization;

(2) tends to equalize gasoline pressure;

(3) removes gums, rust flakes and other impurities before they can foul carburetor jets permanently or even momentarily. Result: you save $20-$35 in periodic carburetor cleaning expense, and get improved mileage and performance.

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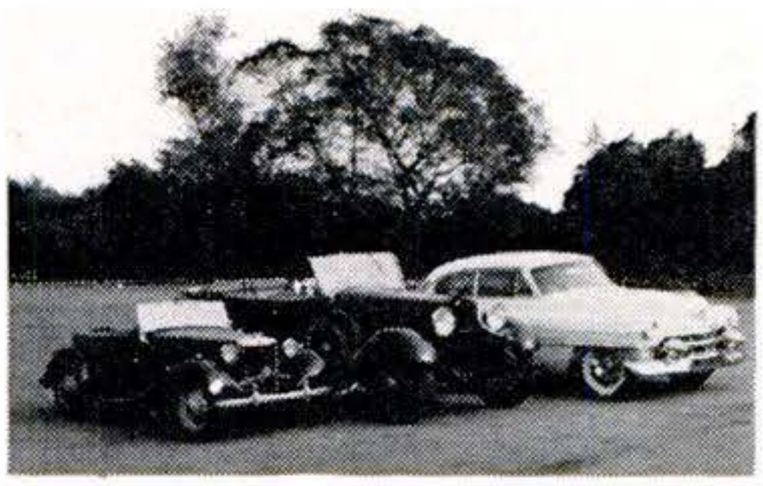
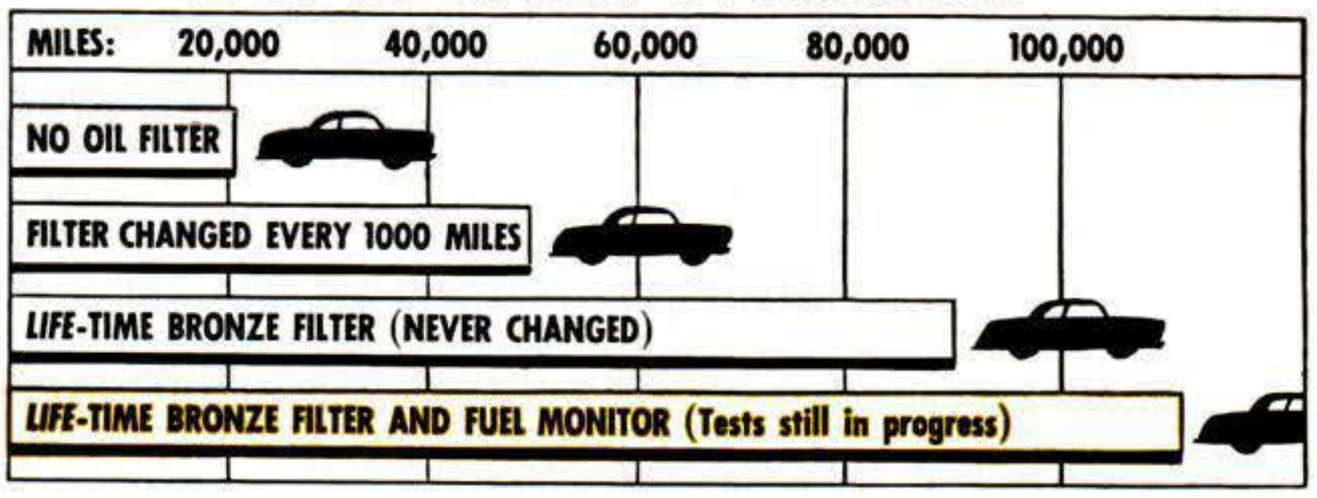


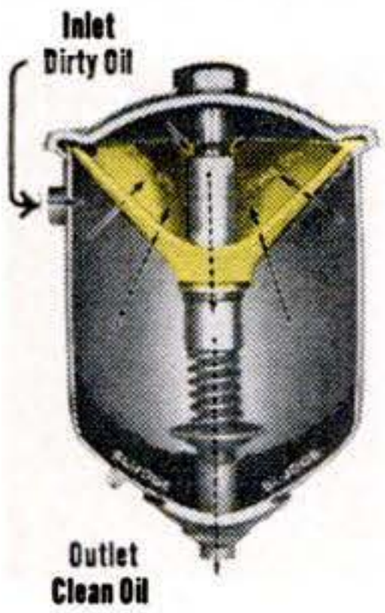


ROAD TESTS *in cars of all makes and models prove engine life is virtually unlimited when gums, tars and damaging abrasives are kept out of oil and fuel systems.*

Genuine Life-Time Oil Filter Gives Your Engine 250,000-Mile Protection Against Acid, Abrasive Damage

Here's the original, genuine *Life*-Time* permanent bronze oil filter tested and approved by the editors of leading automotive and scientific magazines. The only bronze oil filter ever to pass government shock and vibration tests, the genuine *Life*-Time* filter removes *all* abrasives—including granular, diamond-hard carbon which gets through other filters—plus acid-producing water. In addition to *preventing acid formation*, the *Life*-Time oil filter has a special acid-neutralizing component which *actually destroys residual acids that have already formed in your oil system.*

How the Life-Time Oil Filter Works*



Test vehicles have already exceeded the 250,000 mile mark with the *Life*-Time* filter. You never change it; just rinse it out and it is good as new.

Dirty oil enters at top. Impurities, stopped by bronze screen, fall to bottom of case. Filtered oil, including additives, returns to lubrication system.

Try the Life-Time Fuel Monitor and Life-Time Oil Filter for 30 Days at Our Risk!

You can try either or both on this guarantee: you must be convinced they do everything we say, or money back, no questions asked!

For complete *Life*-Time oil filter unit, including case (fits any car), send make, year and model of your car and $12.95 (we pay shipping).

Life-Time oil filter conversion kit, which replaces your present filter pack with Life-Time bronze, is $6.95 for most cars (send make and number of present filter when ordering). Conversion kits for Buicks with hydraulic lifters and for cars with full flow systems: $13.95.

Or send only $2 deposit, pay C.O.D. charges on arrival. But do it today—don't waste another cent on filter pack replacements!

To try the Life-Time Fuel Monitor, simply send $3.95 (we pay postage) or send $1 deposit, pay C.O.D. charges on arrival. If you're not convinced in 30 days it's worth four times the price: money back, no questions asked!

LIFE-TIME PERMANENT BRONZE FILTERS

Continental Manufacturing Corporation, Dept. CPS-6
Washington Boulevard at Motor Avenue, Culver City, California © 1954

*Don't confuse the original, genuine *Life*-Time filter with imitations and "improved" substitutes. Only the original, genuine *Life*-Time filter has passed government shock and vibration tests and meets military filtering requirements. Look for this trademark: LIFE-TIME

DEALERS AND DISTRIBUTORS: find out how you can cash in on demand generated by two-page and four-page ads in national magazines, plus radio and TV network shows and full-page newspaper ads. Write today for full information on *Life*-Time Fuel Monitors, Oil Filters, Batteries, Spark Plugs and Power Brakes. Continental Manufacturing Corporation, Dept. CPS-6, Washington Blvd. at Motor Ave., Culver City, California.

Continental Manufacturing Corporation, Dept. CPS-6
Washington Blvd. at Motor Ave., Culver City, Calif.

Gentlemen:

I will road test the products checked below in my _____ (make, model, year of car)

(___) Fuel Monitor ($3.95)

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I enclose (___) cash; you pay shipping

(___) $2 deposit; will pay C.O.D. charges on arrival.

You will refund my money for either or both products if I return them within 30 days.

Name_____

Address_____

City_____ Zone___ State_____

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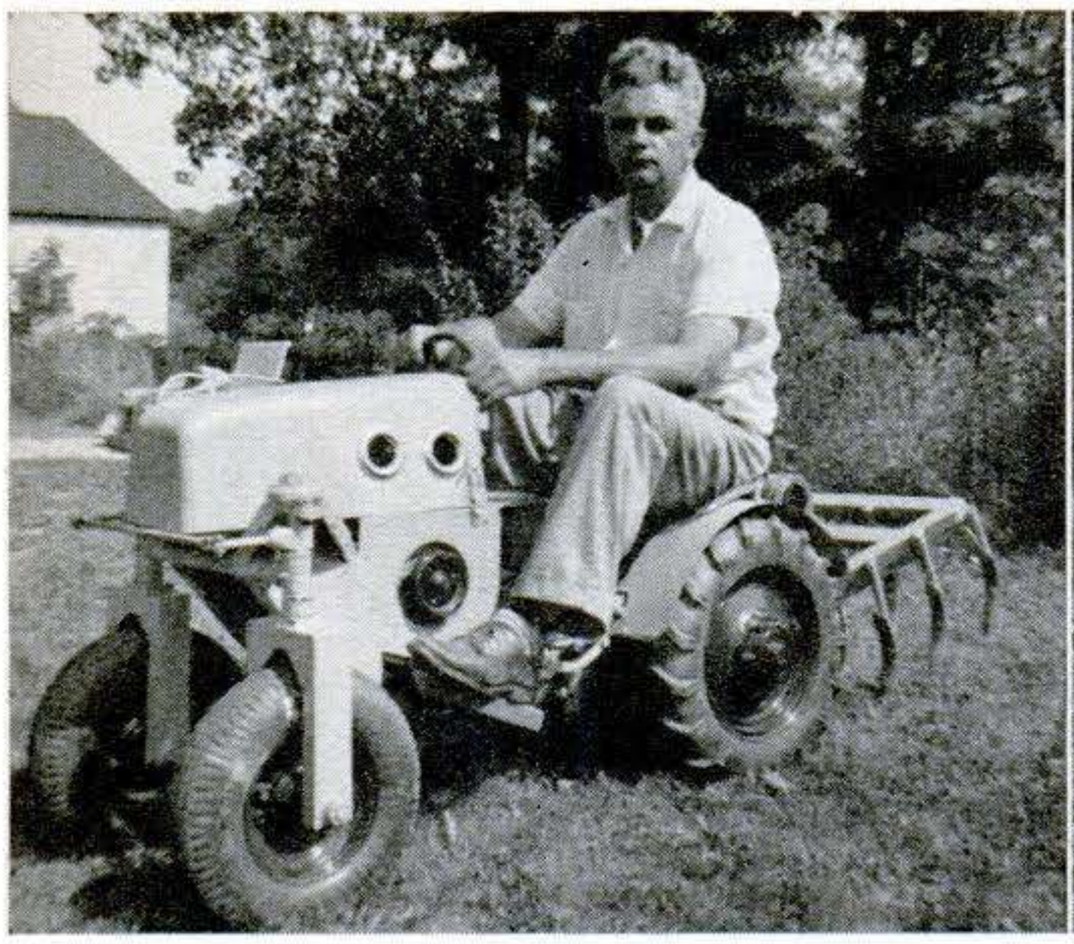
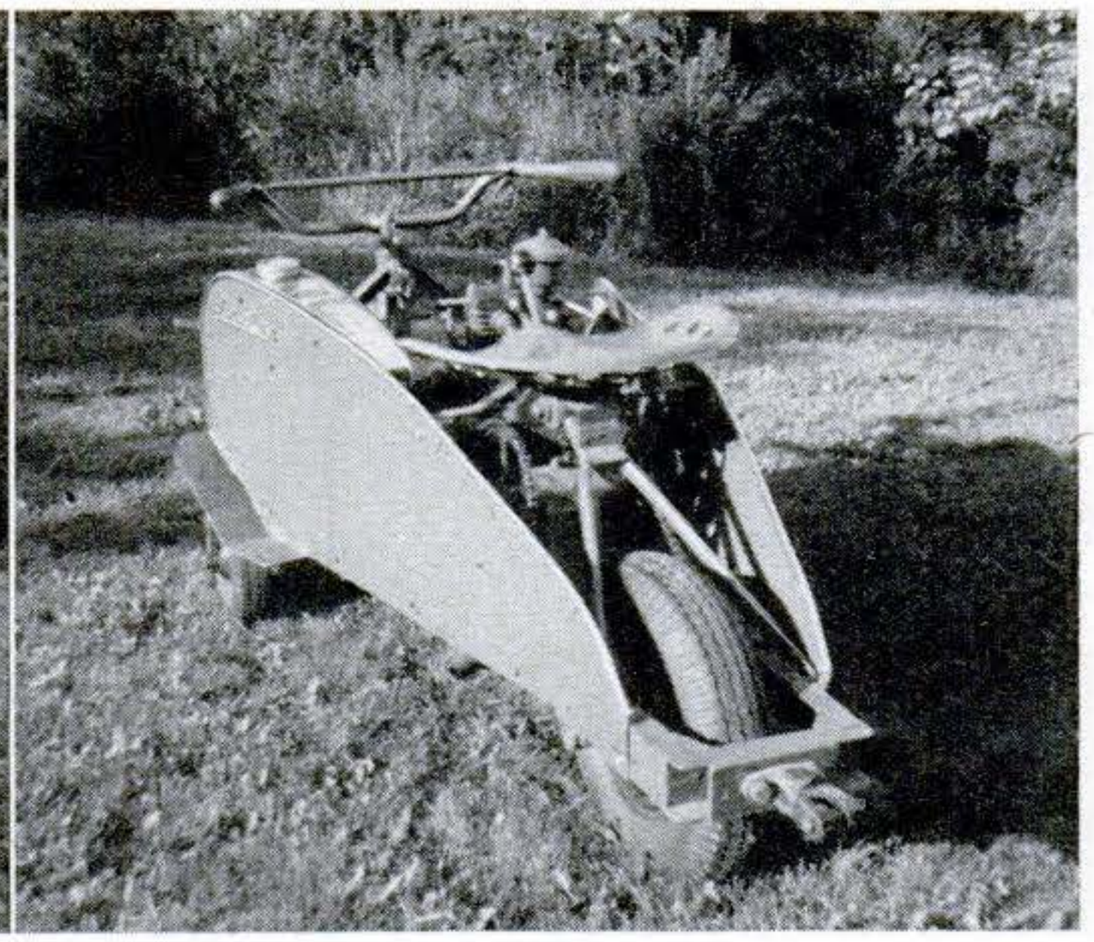


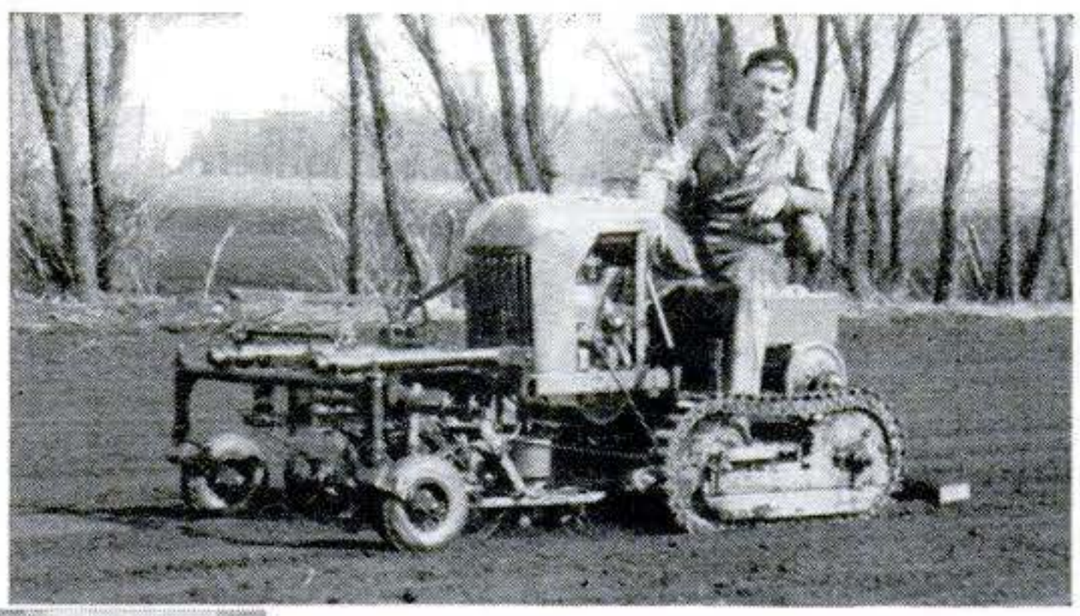


Two Units Handle All Work. Alexander Owen of Schenectady, N.Y., motorized his equipment with two homemade tractors.

The one at left, powered by a two-hp. engine, is for cultivating, hilling and the like. It has a Model A transmission and final drive by Ford rear-end gears. A Chevvy fuel pump feeds gas from its low tank.

The other, with built-in 50-lb. air compressor, hauls a tree-spraying outfit on a trailer. Its 1½-hp. Briggs & Stratton engine will also pull a 300-lb. lawn roller.

Rides on Caterpillar Tracks. For planting and cultivating three rows at a time, John Eicher of Berne, Ind., built both a tractor and cultivator. On sprocket wheels and roller-type tracks, the tractor is powered by a three-hp. Wisconsin engine and steered through the differential, which is hooked up to the motor through an old transmission and V-belt clutch.



Ford-Chev-Buick Model. Old cars furnished most parts for this powerful rig built by Ralph Steider of Aurora, Neb.

A cut-down Ford T rear end was welded to an angle-iron frame and fitted with Chevrolet hubs and wheels. The engine drives a countershaft made from a Buick water pump and carrying a three-step pulley.

This in turn drives a similar pulley on the worm shaft of a steering gear. The worm gear is welded to the differential pinion shaft. Rear wheels are swiveled.

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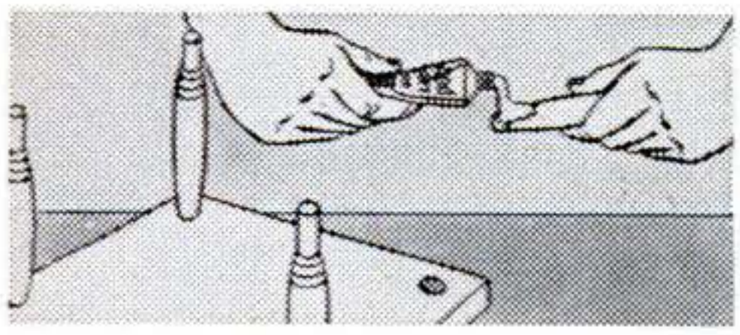
NOW! Put up Plywood Panels *Without Nails!*

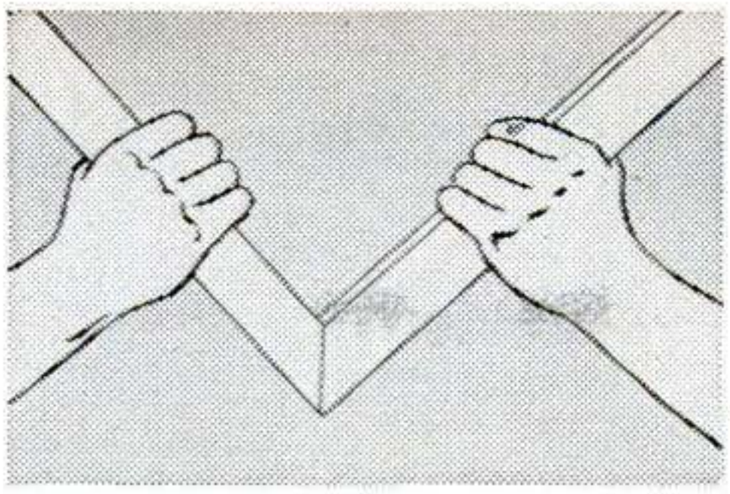
It's a revolutionary construction technique! Made possible by a new adhesive...Weldwood Contact Cement! Lets you put up plywood with ease. Ends nail-setting and puttying. No finishing unsightly nailholes. You install the plywood panels directly to studs or furring strips. Makes prefinished plywood paneling more practical than ever before!

Weldwood Contact Cement bonds instantly without clamps or presses. 1001 uses in every home, shop, garage. For bonding wood, aluminum and other metals, cloth, felt, paper, leather, fiberglas, rubber. Wonderful for applying Micarta — without clamps or presses.

NOW! A Special Weldwood® Glue for Hobbyists!

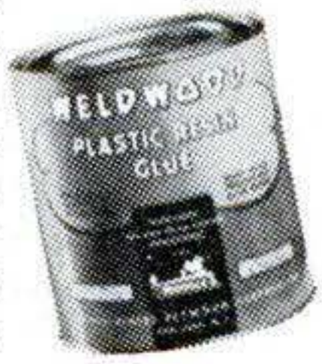
It's ready-to-use! It sets fast! It bonds like magic! It's Weldwood Presto-Set Glue! The first white glue worthy of the Weldwood name. Just brush or swab on. Bonds wood to wood ...wood to cloth...cloth to paper...upholstery fabrics to wood...leather to leather...many other uses. Jobs can often be worked in 20 minutes after gluing. It forms a bond that *stays* strong. See how it speeds things around your workshop . . . see how it handles toughest jobs like magic!





Makes Glued Joints even Stronger than Wood!

When your job demands professional results...or where water-resistance is important...use the glue that professional cabinetmakers love to use ...Weldwood Plastic Resin Glue. It's just about the best wood glue there is! Actually makes glued joints stronger than the wood itself! Grows even stronger with age. Highly water-resistant, stain and rot-proof. Spreads smoothly and easily. A little goes a long way. Where quality counts most, there's no substitute for Weldwood Plastic Resin Glue — deservedly America's largest selling wood glue.



Weldwood Glues — First Choice of Professionals!

Industri[illegible] woodwor[illegible]ers, builders and profess[illegible] c[illegible]bin[illegible]rs know their [illegible] t stake, every t[illegible] them, only t[illegible] and the be[illegible] ood Gl[illegible]s. [illegible]ros" wi[illegible] the W[illegible]e the[illegible]ons of [illegible]hich insti[illegible]me! Weld[illegible] har[illegible] ever[illegible] builders [illegible] makers [illegible] are a[illegible] job. So fo[illegible] good enoug[illegible] best in

Weldwood® Glues . . . Satinlac® Firzite® are available at all hardware, lumber and paint dealers.

Make Inexpensive Plywood Look Rich and Costly!

Here's the easy way to "tame wild grain" on fir plywood stain jobs . . . and get the appearance of expensive woods. Start with a base coat of *Clear* Firzite®! Subdues wavy grain. Helps end grain raise and checking. For oak, walnut, or mahogany stains, add colors-in-oil.

How to Get that "Woodsy" Blond or Pickled Effect!

Blond, pickled or wiped effects are really popular. Get them easily on any kind of wood, without a "painty" or artificial look — with *White* Firzite. It brings out the handsome "woodsy" quality. For tinted effects add colors-in-oil. (On soft wood or fir plywood paint jobs, *White* Firzite as an undercoater helps prevent grain raise and checking.)

Quick Way to Accent Natural Beauty of all Woods!

Apply Satinlac® for a rich satiny effect which wears well and is easily maintained. The full beauty of the wood grain is accentuated and protected! Won't discolor with age. Dries so quickly, it's ready for the next coat in 3 or 4 hours.

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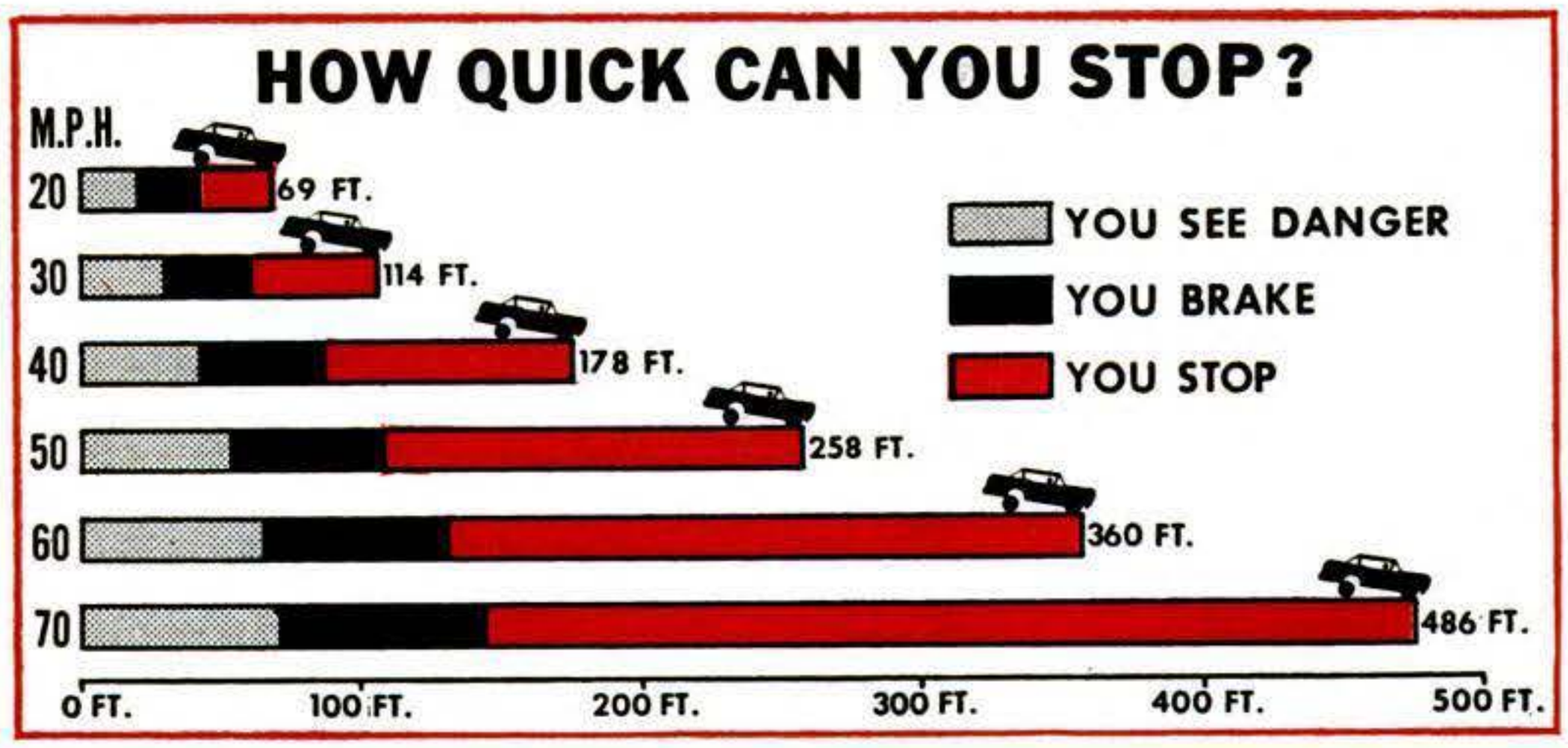
POPULAR SCIENCE MONTHLY'S . . . **Last-minute news & notes**

A RADIO SEXTANT FOR SHIPS can "see" through the dirtiest weather to measure the height of the sun and thus find position. The first real change in the sextant in 200 years, this Navy device finds the sun by tuning to the radio noise it emits...RADIO SIGNALS FROM THE PLANET JUPITER have been picked up by Drs. B. F. Burke and K. L. Franklin of the Carnegie Institution. Sounds like thunderstorm static, they say--not messages from intelligent Jupiterians... TELEVISION HELPED CHOOSE SCHOOL PRINCIPALS from 700 New York City teachers. Applicants observed, on TV, a demonstration class in action, then wrote reports.

WANT THE PLANS FOR THE NORDEN BOMBSIGHT? You can get them for a quarter from the U.S. Patent Office, which just issued a patent (No. 2,703,932) on the famous device, now obsolete. It was so secret that Carl L. Norden did not even apply for a patent until 1945, although his original invention dates from 1923... ARTIFICIAL EYES THAT MOVE AND TWINKLE are being furnished to some wounded veterans by the Veterans Administration. Magnets do it. One, plastic cased, is attached to the muscles of the missing eye to pull on another magnet inside the artificial eye... THE TIME IT TAKES TO RECOGNIZE DANGER and know you have to hit the brakes is allowed for in the new stopping-distance chart (left), recently adopted by safety organizations. This perception time is figured as equal to reaction time (¾ second), the interval between recognizing danger and applying the brakes.



A GHOST VOICE TALKS IN A NEW OPERATORLESS ELEVATOR. The magnetic tape, developed by Westinghouse, can even say: "Second floor, ladies' underwear, dresses..." ...A RADIOACTIVE FIRE DETECTOR senses combustion gases before smoke and flame appear. C-O-Two, Newark, N.J., explains that it responds to changes in electrical conductivity of the air.

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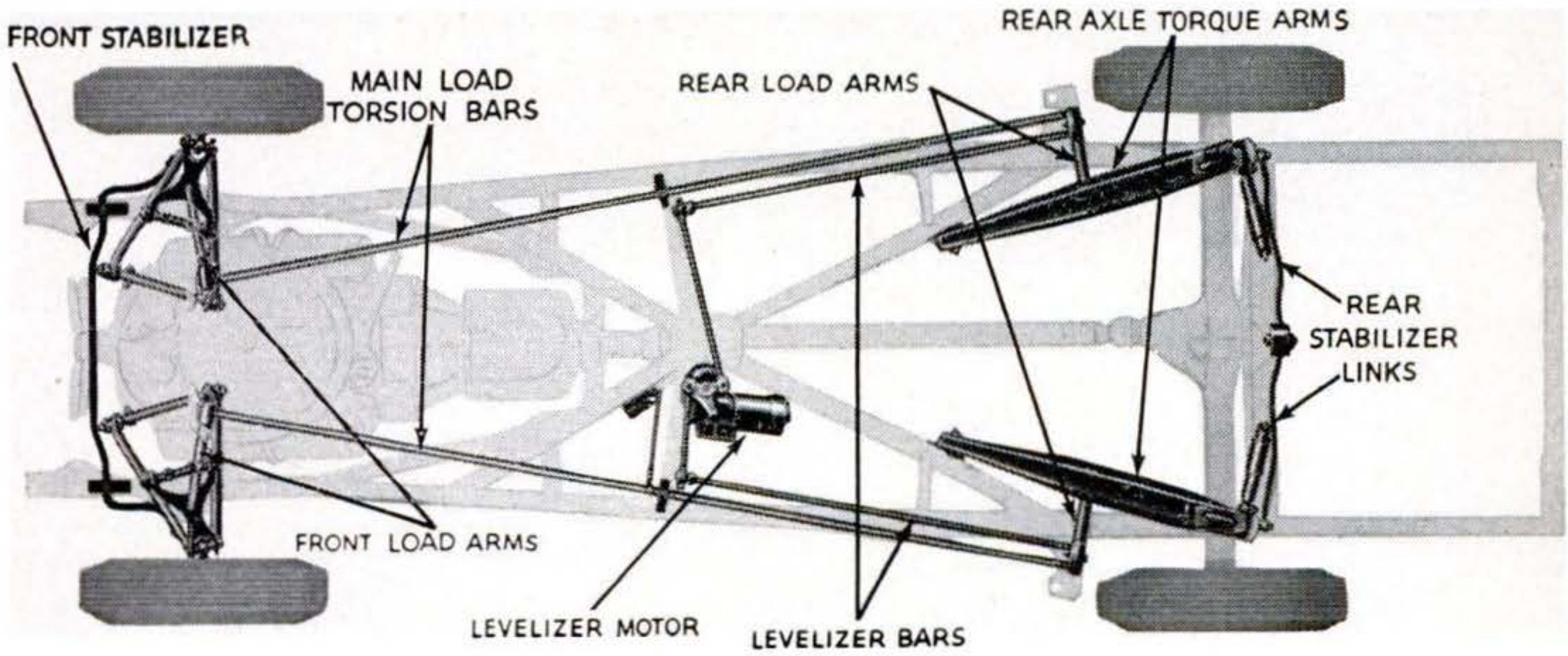
GREATEST RIDE DEVELOPMENT IN AUTOMOTIVE HISTORY



Torsion Suspension has two long, torsionally flexible bars, four pivoting arms (called "load arms"), and four links. These support the frame and body.

The Levelizer (Compensator) has two short "levelizer" bars connected at one end by links and levers to a two-way motor with reduction gearing and at the other end to the rear of the main torsion bar load arms.

Rear Axle Mounting—Driving torque arms connect the rear axle housing to the frame. Side movement of the rear axle is controlled with two transverse stabilizer bars, allowing only true vertical axle movement.

NEW PACKARD

TORSION-LEVEL RIDE

A Sensational New System of Suspension Eliminates Conventional Coil and Leaf Springs

Smooths the Road . . . Levels the Load *Automatically*

HERE'S WHY the *new* Packard Torsion-Level suspension gives you comfort unequaled by any car on any road . . . whether super-smooth or rugged and rutted.

In other cars, twisting forces due to wheel shock are transmitted to the frame. You submit to resulting pitch and bounce, the car is subjected to wracking of frame and body. In the *new* Packard, these same twisting forces are transmitted along the new torsion bar system and absorbed *before* they can reach either frame or passengers.

Torsion suspension has two "main load" torsion bars running the full length of the frame on each side connecting a front and rear wheel and making them work as a team. Each "team" acts as a longitudinal stabilizer, reducing "pitch" and "dip" much as a transverse sway bar stops side roll. As the wheels move up or down, four pivoting arms (called "load arms") transmit twisting force to the main torsion bars, which, in turn, tell the wheels how to react to bumps and ruts.

A new type of front and rear stabilizer control helps give better handling on sweeping curves and tight corners. And an ingenious power-controlled levelizer compensates for changes in passenger and luggage load, and automatically keeps the car always at "flight-level."

But to fully appreciate this new kind of ride, visit your Packard dealer . . . take the key and see . . . let the ride decide.

"Ask the Man Who Owns One."

PACKARD DIVISION • STUDEBAKER-PACKARD CORP.

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Let's go- just touch the button!

"soft touch" for worlds of fun!

Evinrude *electric starting*

You're *really* in the driver's seat with this one! And thanks to your Big Twin Electric you can stay right there! *In pampered ease!* For days and months of carefree push-button boating! You'll love it! Your wife will love it! Now boat handling is an all-the-family affair!

Is it new . . . tricky . . . untried? No, sir! Introduced by Evinrude a full year ago, the flawless performance of Big Twin Electrics has been certified by millions of owner miles on waters everywhere. And this year—*finer than ever!* You'll speed in the tranquil quiet of revolutionary *Whispering Power*. You'll relax in blissful smoothness that makes riding seem like sailing!

SEE YOUR EVINRUDE DEALER. Look for his name under "Outboard Motors" in your phone book. He will gladly demonstrate the Big Twin Electric, or any of the complete range of Whispering Power Evinrudes . . . now there's a model for every type of boat! **CATALOG FREE!** Write today for big, full-color catalog of the complete Evinrude line. **EVINRUDE MOTORS,** 4606 N. 27th Street, Milwaukee 16, Wisconsin.

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all are quiet!

ELECTRIC BIG TWIN *Aquasonic,* 25 h.p.* The *proved* electric starting outboard. **$525†**
BIG TWIN *Aquasonic,* standard model. **$430**
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LIGHTWIN *with Fisherman Drive* **$145**

*All ratings OBC certified at 4000 RPM tested in conformity with SAE test code. †Prices F.O.B. factory subject to change without notice.

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Pioneers in **quiet** *Outboard Motors*

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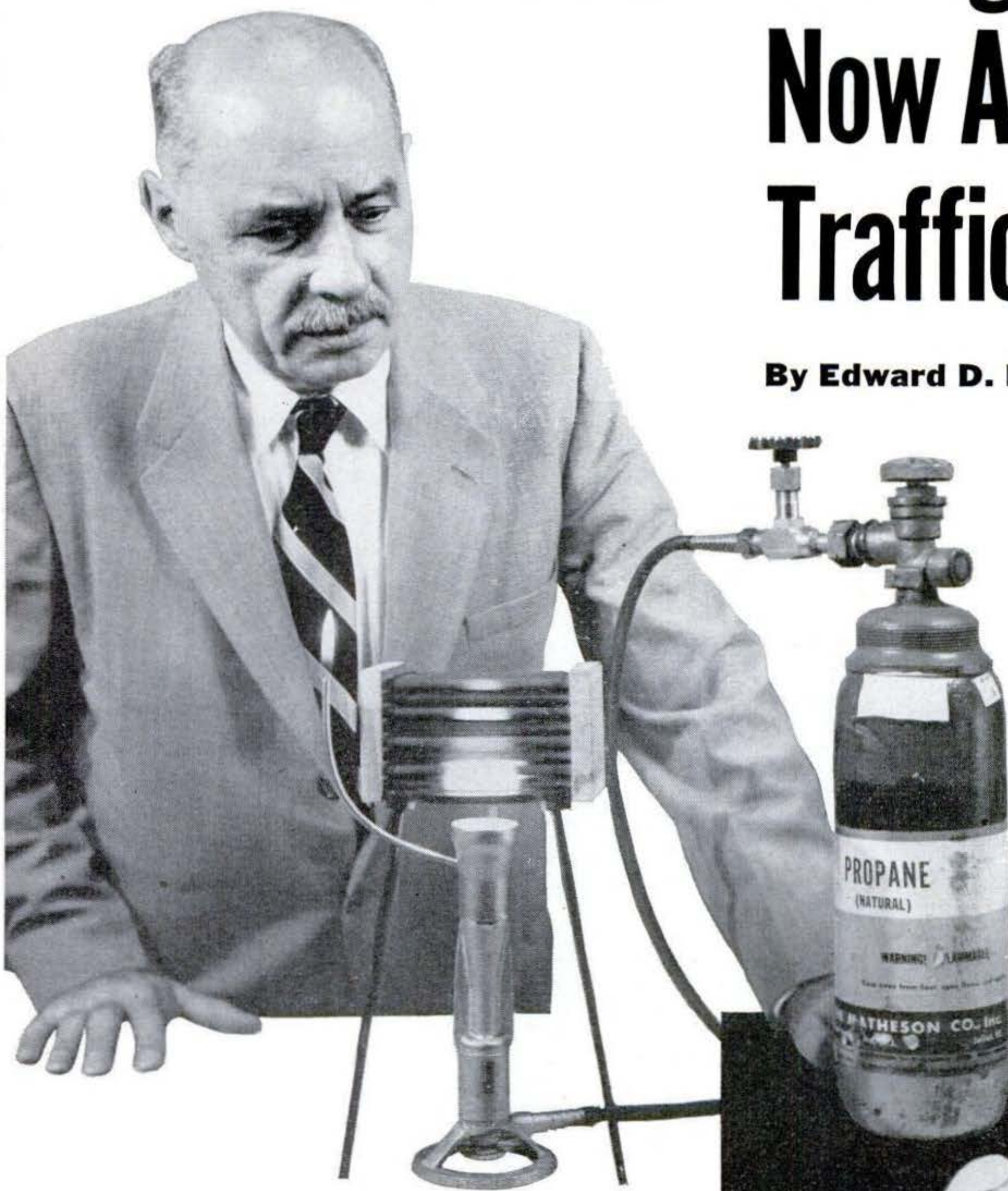
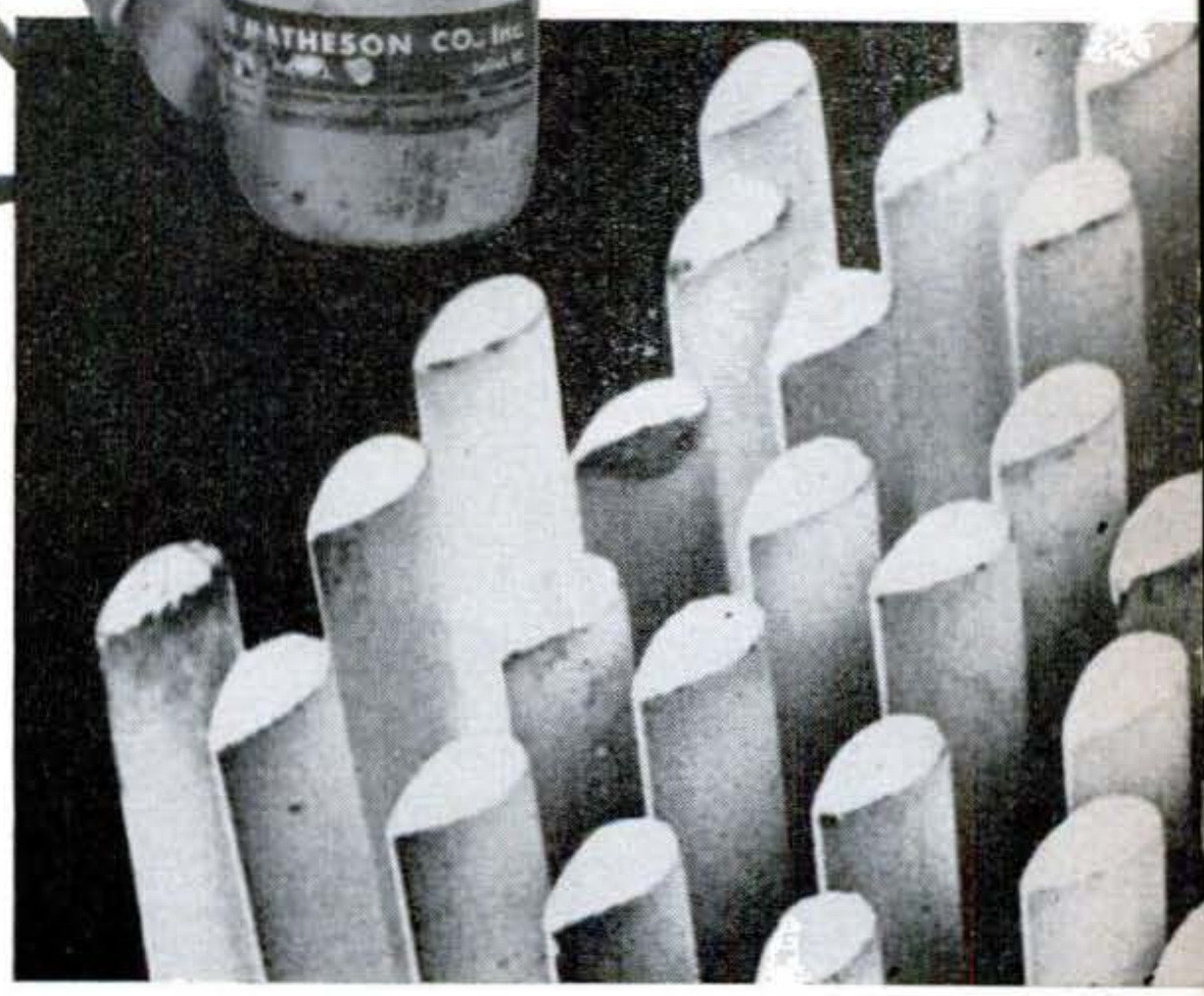
POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

His Smoke-Eating 'Cats' Now Attack Traffic Smog

By Edward D. Fales Jr.



GLOWING "CAT" UNIT above Bunsen burner converts noxious carbon monoxide from propane gas into harmless vapors that blow right into the face of inventor Eugene Houdry. Pilot flame at left shows gas burning without cats. Below is open-end view of the chemically treated rods that do the converting job.



ONE of these days you are going to take a whiff of your car's exhaust —and get a surprise. The greasy smell will be gone. So will the blue smoke. And the black gookum that now streaks your driveway. When this welcome change has come over enough cars, there will be fewer scare headlines about smog. For all that, you may want

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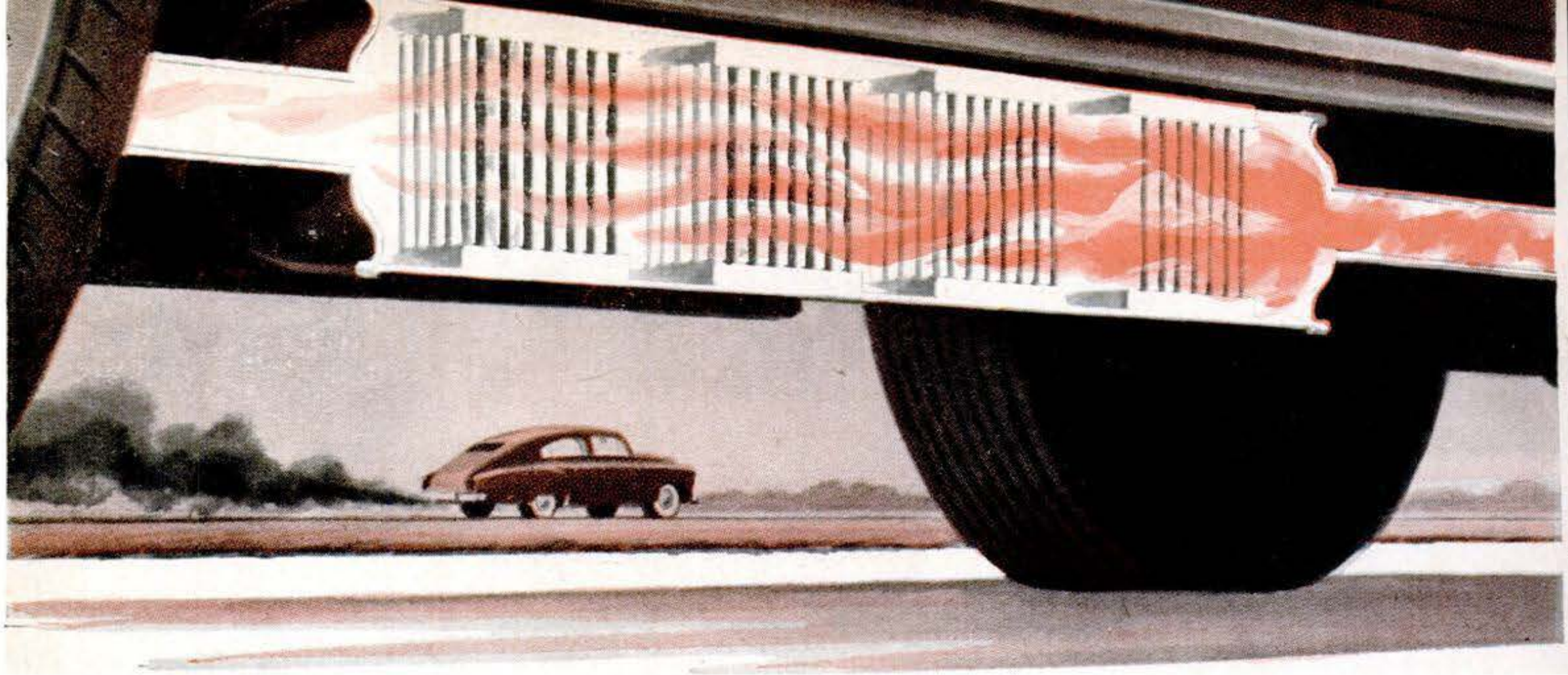

With fume-swallowing cats riding under the chassis, automobiles would no longer smell up

to thank Eugene J. Houdry and his smoke-eating "cats."

The fascinating chemicals called "cats"—short for catalysts—have occupied Houdry for 30 years. He and his cats gave us one process—cat-cracking gasoline—that helped win the war. Today in a dozen cities, you can find another breed of his cats perched high in smokestacks, fighting industrial smog and smells. You can find them also in hundreds of fork-lift trucks—the antlike wonders that bustle around our factories hauling loads many times their size. And some day they will be working in your kitchen.

But right now Houdry has sicked his cats on the fumes—sometimes dangerous—that come from your car.

DEADLY FUMES CAN'T PUFF from this fork-lift truck as it works indoors. Fork-lifts were Houdry's guinea pigs for Oxycat treatment. Man in photo points to smoke-muffling unit.

Auto men have their eyes on a 20,000-mile test being run in Texas by the Air Pollution Foundation with six cars fitted with new Houdry fume-eating mufflers. These are something like your acoustical muffler, but they're stuffed with Houdry's wonderful cats.

Nobody is saying—yet—how the auto muffler works. But you may get an idea from the way the cats work in lift-truck mufflers. Inside each muffler is a veritable forest of streamlined porcelain rods, some 400 in all. Each rod is coated with a catalyst.

A catalyst is like a heckler who prods two *other* guys to fight. A cat never does much fighting himself—he's needed to keep things stirred up.

In your car's exhaust pipe the trouble is that nobody wants to fight. The waste hydrocarbons and carbon monoxide coming down from your engine aren't hot enough to mix it up with oxygen—in other words, burn. Like snakes on a cold day they are too lazy to fight.

So Houdry throws in a cat, and—wham!—a fight starts. Oxygen from the air leaps with a snarl at the smelly stuff. While the cats glow with the heat of the fight, oxygen rips the hydrocarbons apart. The hydrogen joins some of the oxygen to form water (H_2O). And the widowed carbon is swallowed by other oxygen, burning into harmless carbon

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or smog up our crowded streets and highways.

dioxide (CO_2). Deadly carbon *mono*xide (CO) gets the business, too. Attacked by oxygen, it also burns to CO_2.

Months of road-testing, Houdry's Oxy-Catalyst, Inc., reported, resulted in elimination of 85 percent of the smelly hydrocarbons and 98 percent of the CO.

Born in France, Houdry developed his cat-cracking process for making gasoline there in 1927. He was already famous when the Vacuum Oil Company brought him to America as a consultant in 1930. Since then he has lived at Ardmore, Pa. For years an ivy-covered stable behind his home was his private lab, where he worked to find new jobs for his cats.

A few years ago, Houdry heard about the troubles companies were having with fork-lift trucks inside buildings: exhaust gases simply wouldn't burn up.

Houdry and his staff found a new cat to do the job—a platinum alumina alloy. They coated porcelain bars with .003 inch of this cat and put the unit in a lift truck's muffler. Presto: with heat but no flame, the gases burned.

Cats in the chimney followed. Houdry was already thinking about automobiles when, one day three years ago, a worried man strode into the Ardmore stable. He was Arthur Uhleen, manager of Enamelstrip Corp., of Allentown, Pa.

On a rainy day in Allentown, he said, 92 citizens had risen in wrath and asked

[Continued on page 244]

MAKINGS OF SMOG belch from the stack at left. The one at right, with cats in its throat, has neither smoke nor smell. Photo below shows how the porcelain-rod blocks are installed in a chimney to prevent air pollution.

Boatbuilder Puts Outboard Inside

THE outboard motor sits smack in the middle of this unique runabout. To achieve this and other unusual features, such as plug-in side wheels for highway travel behind the family car, Richard Manning of New Canaan, Conn., had to build his "dream boat" from scratch.

One of his main objectives was easy maintenance. This he accomplished in several ways. A watertight hatch (raised in upper photo at right, removed in photo at far right to show location of engine) covers the motor. A one-inch lining of spun glass fiber on the hatch is a soundproofer. Glass-fiber cloth, bonded to the plywood bottom, makes the hull watertight. A synthetic fabric in a bold plaid pattern does the same job topside, plus causing considerable comment wherever the inboard outboard goes.

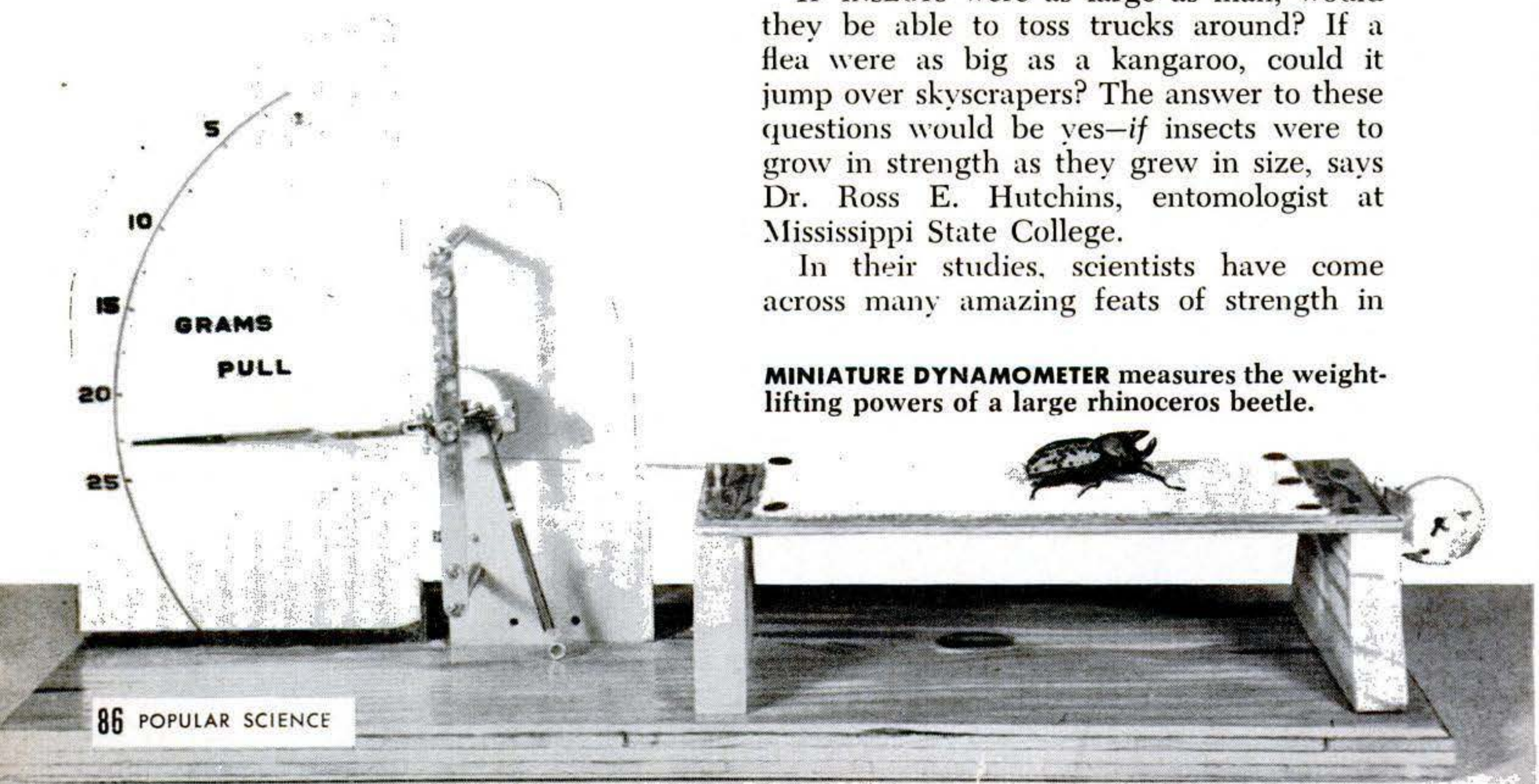
With the motor placed so far forward, it cannot be used for steering control. This is done by a separate outboard rudder. Putting the propeller underneath the hull, however, rather than near the surface at the stern, is a protection for swimmers.

The photo at immediate right shows how rubber-tired wheels are plugged in to make the boat its own road trailer.

Would Giant Insects Be Able to Conquer the World Through

IF INSECTS were as large as man, would they be able to toss trucks around? If a flea were as big as a kangaroo, could it jump over skyscrapers? The answer to these questions would be yes—*if* insects were to grow in strength as they grew in size, says Dr. Ross E. Hutchins, entomologist at Mississippi State College.

In their studies, scientists have come across many amazing feats of strength in



MINIATURE DYNAMOMETER measures the weight-lifting powers of a large rhinoceros beetle.

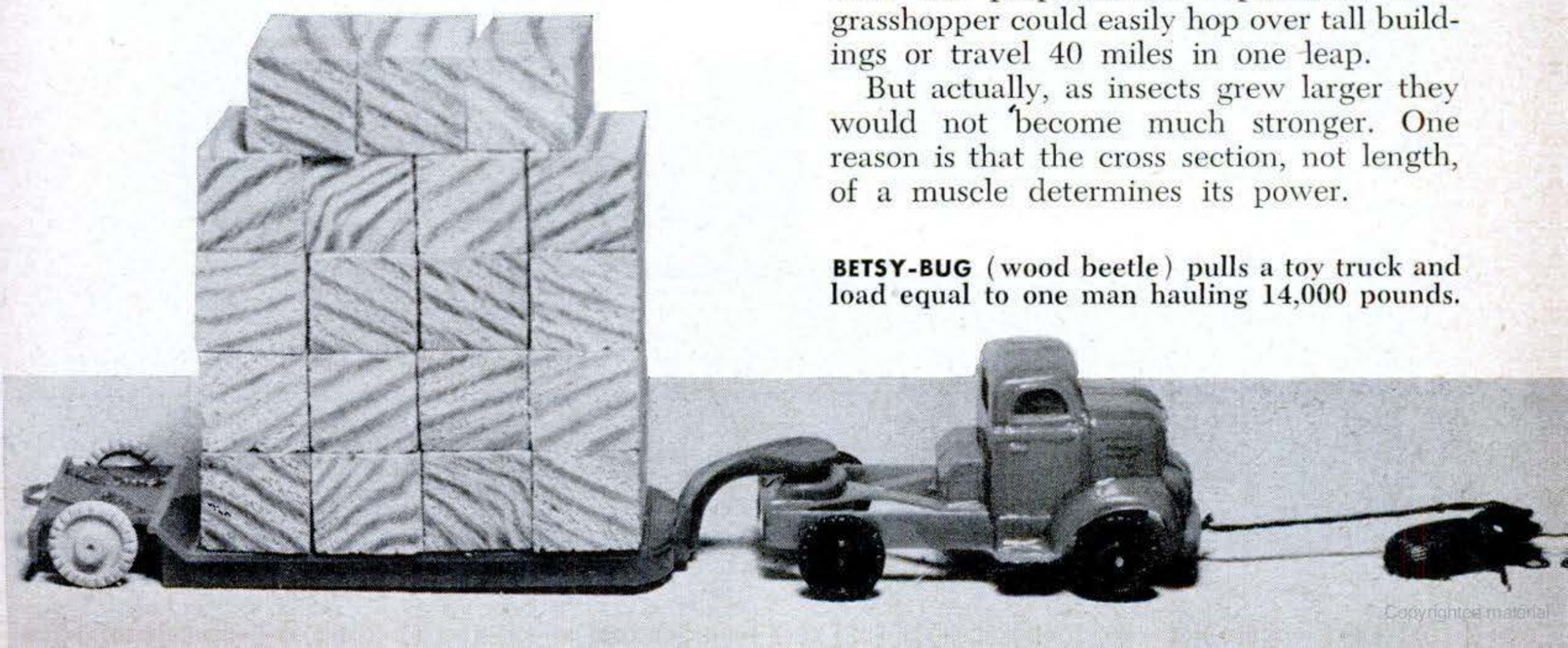
Their Feats of Strength? Scientists Say No. Here's Why

insects, which are probably stronger than any other animal in proportion to size. A harvester ant has been observed moving a stone that was 52 times its own weight. That is roughly the equivalent of a man lifting four tons.

Beetles are the weight-carrying champions for their size. One was able to lift 850 times its own weight on its back. At that rate, an elephant could carry, in theory, 5,000,000 pounds.

Insects are great jumpers, too. A man with the proportionate capabilities of a grasshopper could easily hop over tall buildings or travel 40 miles in one leap.

But actually, as insects grew larger they would not become much stronger. One reason is that the cross section, not length, of a muscle determines its power.



BETSY-BUG (wood beetle) pulls a toy truck and load equal to one man hauling 14,000 pounds.

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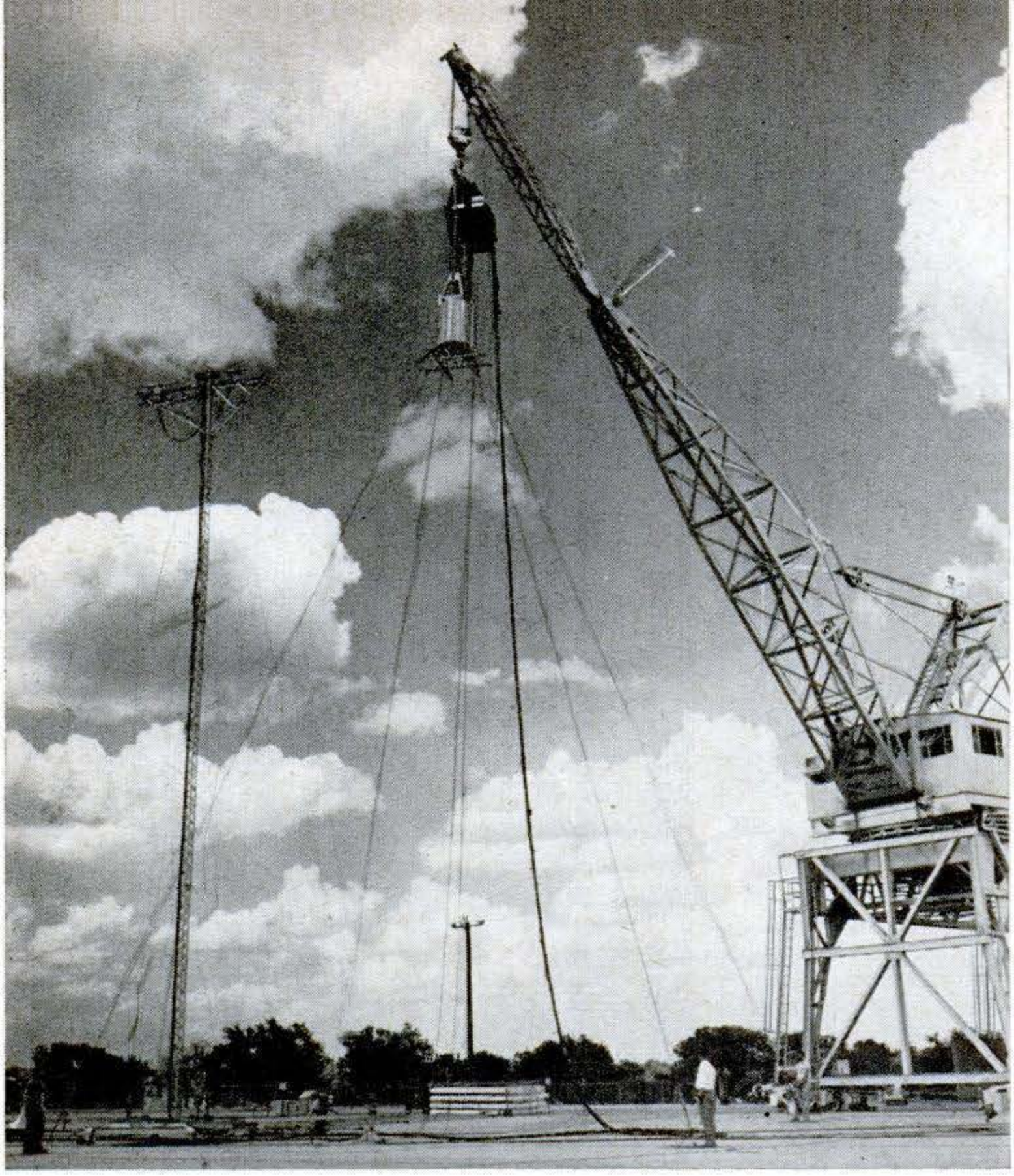


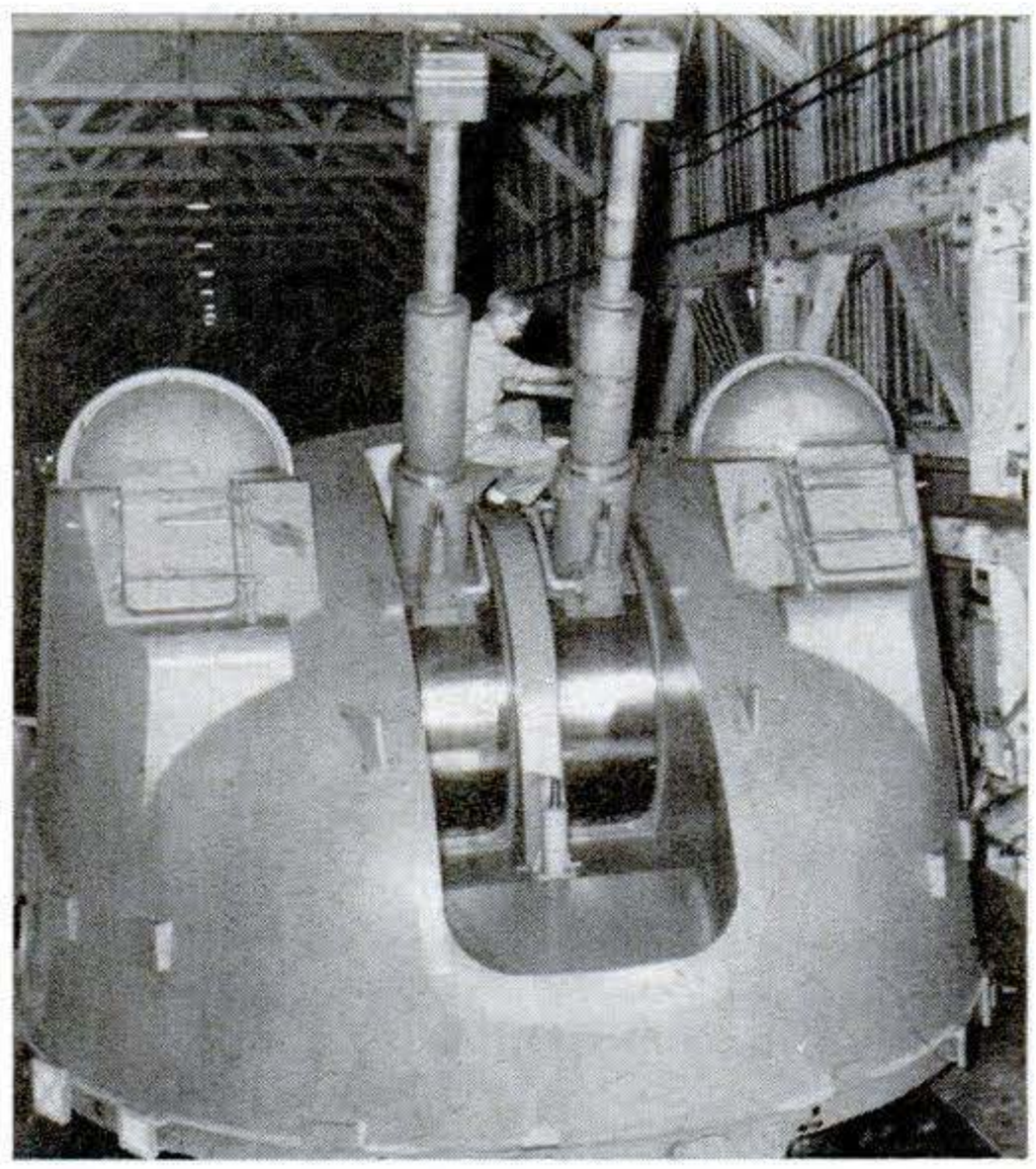
Atomic Furnace Is Tested While Hanging in Air

THAT "ashcan" hanging from the crane is a portable atomic furnace, one of the first in the country. It operates in mid-air while instruments on the tower nearby measure the radiation it produces. The strange test arrangement, shown at the Convair plant in Fort Worth, avoids errors that would be caused by radiation reflected from the earth if the reactor were tested on the ground.

▶▶▶Colored auto tires —blue, green or brown —are now sold by U.S. Rubber Co.

Cast Plastic Makes a Big Ball

A NEW method for casting plastic makes a tough, window-clear material without costly polishing processes formerly required. The cast Krene is supplied by Bakelite in rolls, and can be used for everything from handbags to gaskets—and beach balls.



Navy Gets Fast-Firing AA Gun

THAT huge steel turret above will hold twin antiaircraft guns for split-second firing aboard U.S. Navy ships. At sea, the Mark 37 will carry long three-inch barrels. Stubs with counterweighted tips balance the gun temporarily at a Westinghouse plant.

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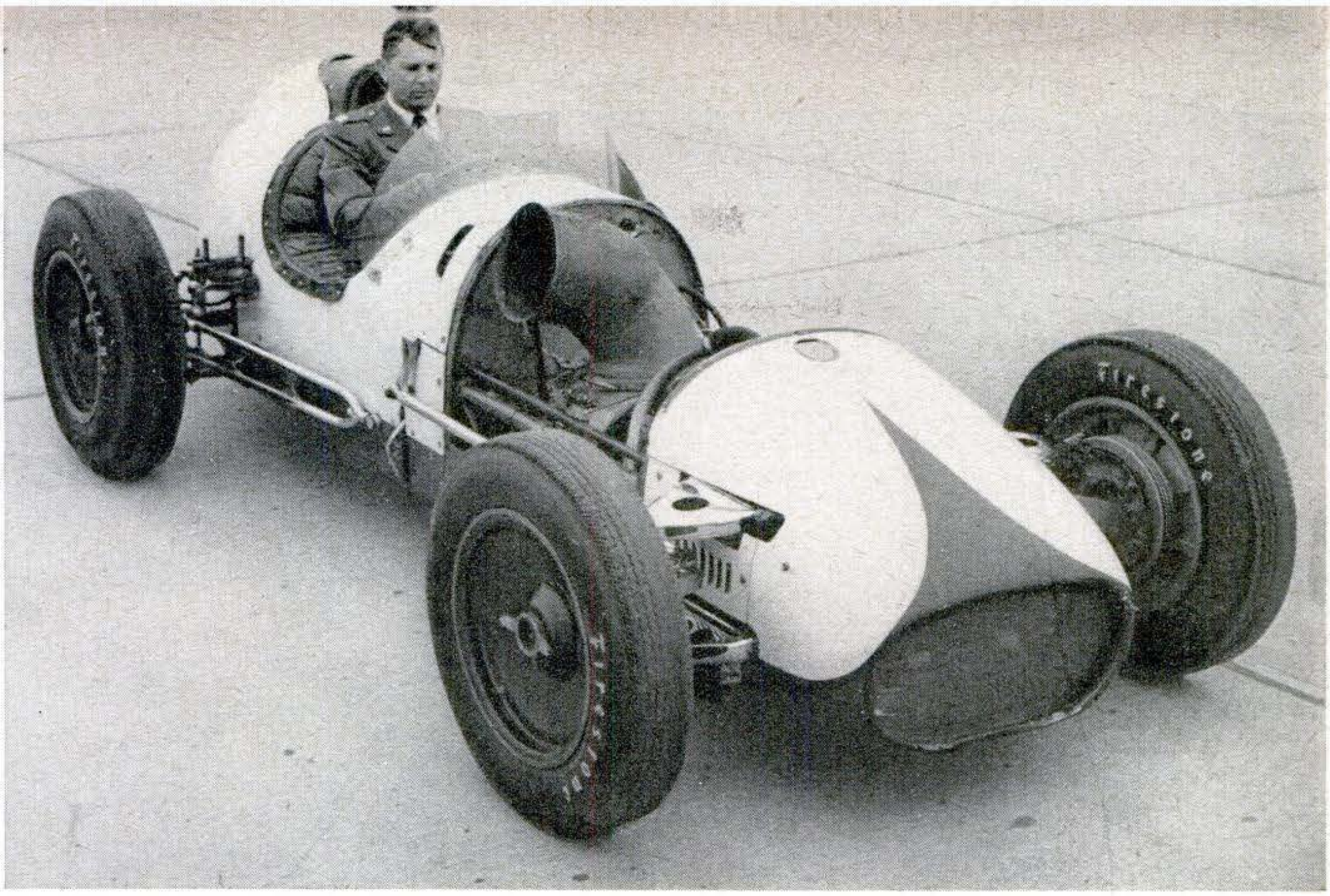


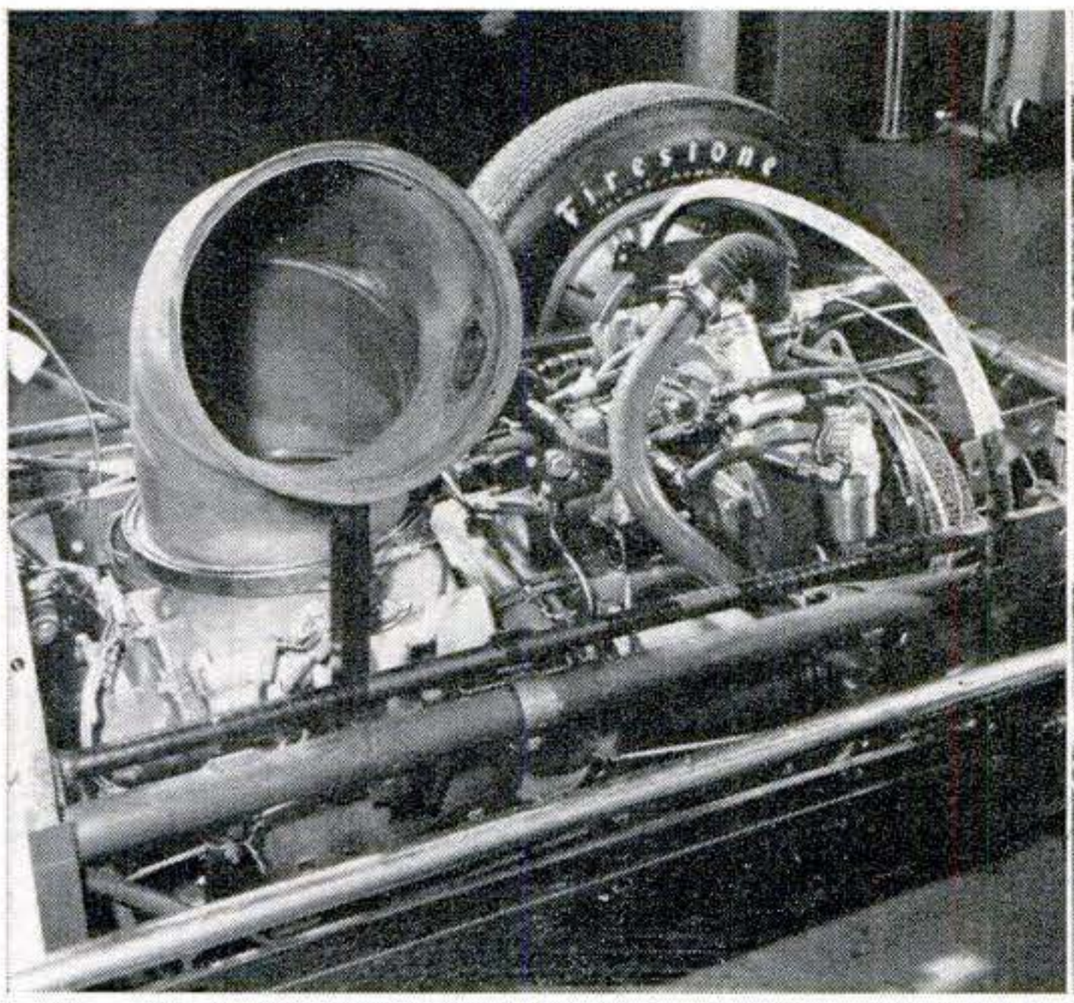
Cockpit of Offutt Hobby Shop turbine car is tried for size by Capt. Hobart Ivins, USAF.

Turbine Drives Retired Racing Car

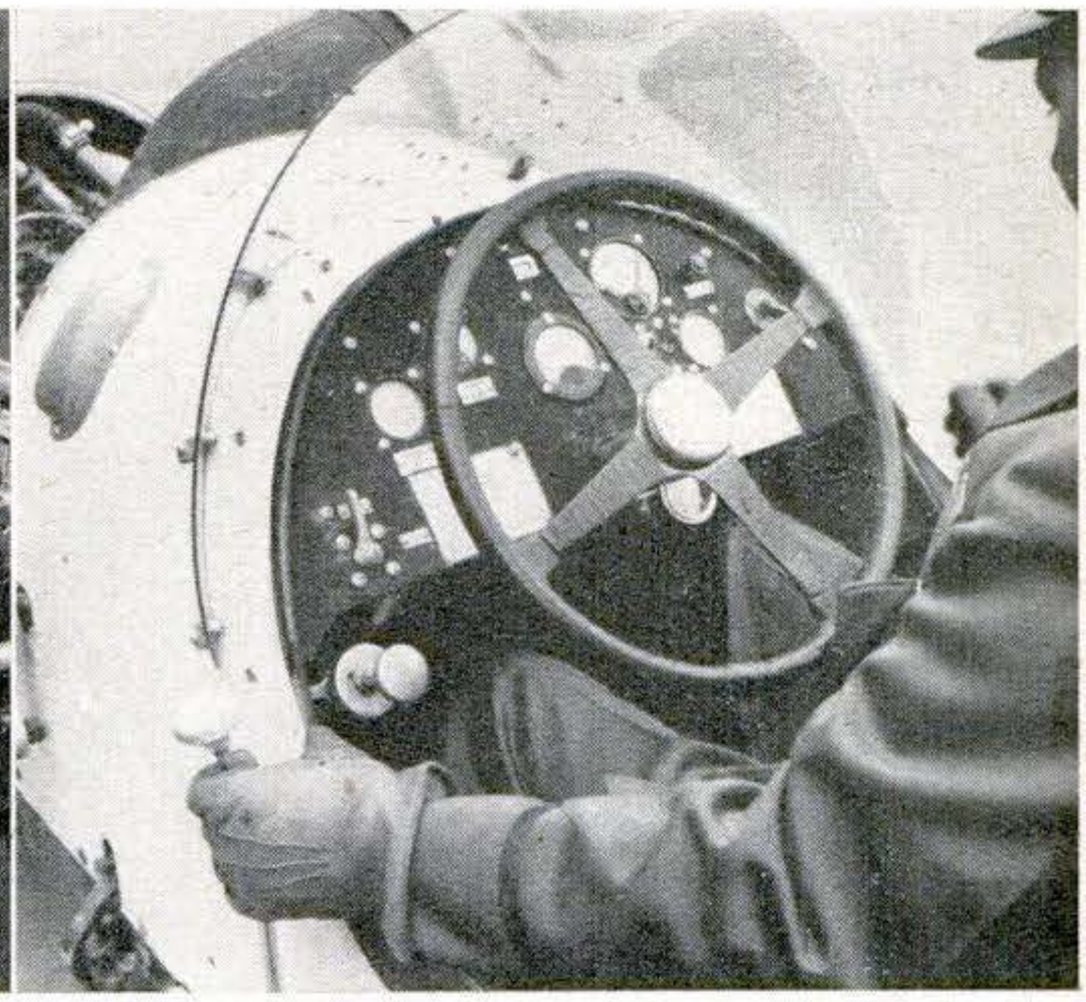
A GAS-TURBINE engine has been installed in a former Indianapolis "500" racing car. It's a hobby project at the Offutt Air Force Base near Omaha.

The work was done by airmen, on their own time and at their own expense, in the base's automotive hobby shop. The engine, operating on the split-turbine principle (PSM, July '54, p. 106), turns out about 185 horsepower. The getaway is fast, but nobody knows the top speed; the car hasn't been opened up.

There is no gearshift. The driver just puts his foot on the brake, fires up, and lets go. Boeing Aircraft owns the turbine, Firestone Tire & Rubber the car. In its original form, it finished second at Indianapolis in 1952.



VENTILATORLIKE HORN atop engine actually is the exhaust. Compressor turbine whirls at 36,500 r.p.m., drives turbine at 24,500. Gear reduction turns output shaft at 3,000.



EXTRA INSTRUMENTS on panel show exhaust temperature and r.p.m. of power and compressor turbines. An air pump pressurizes fuel tank. Air scoops on cowl help cool the cockpit.

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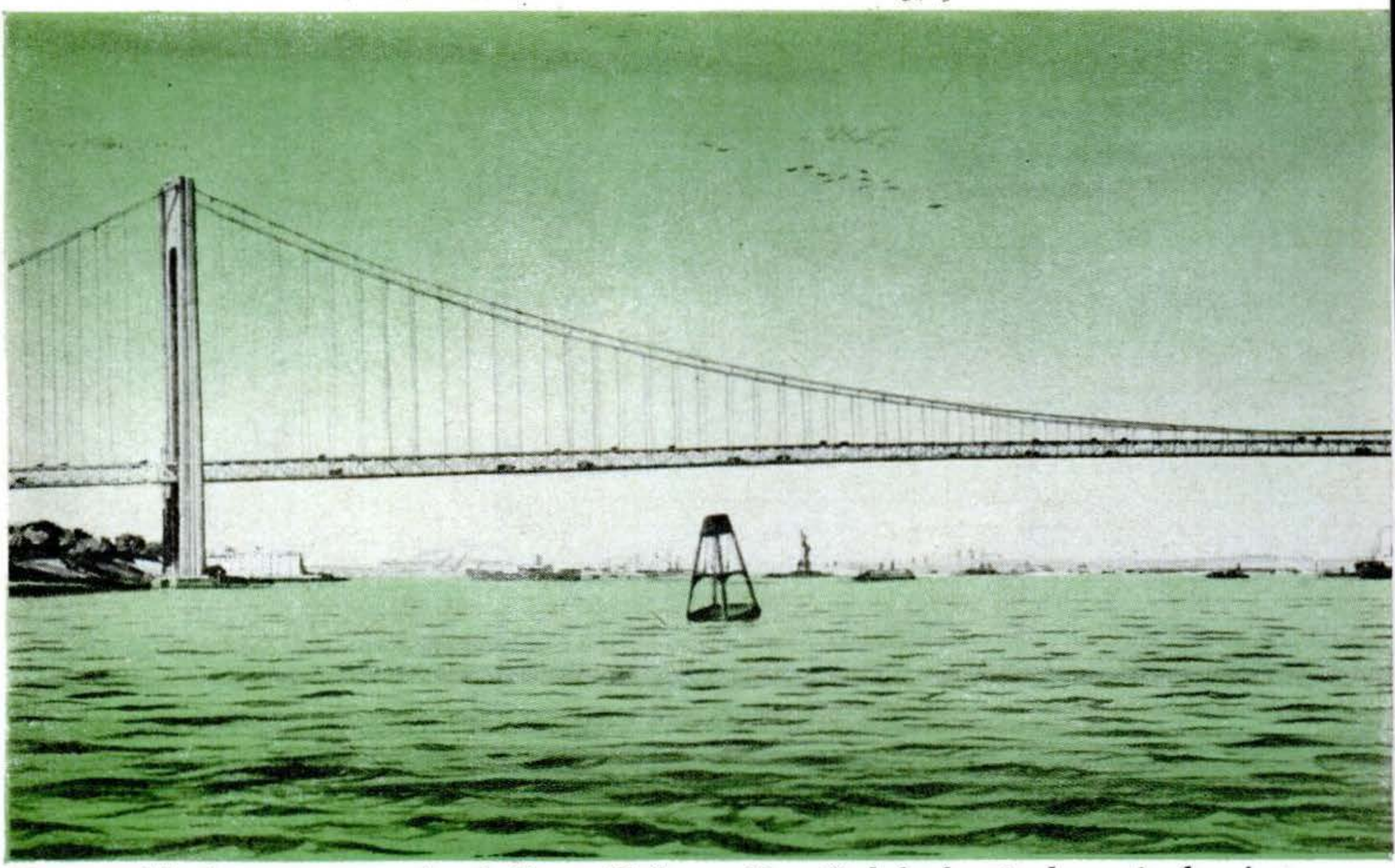
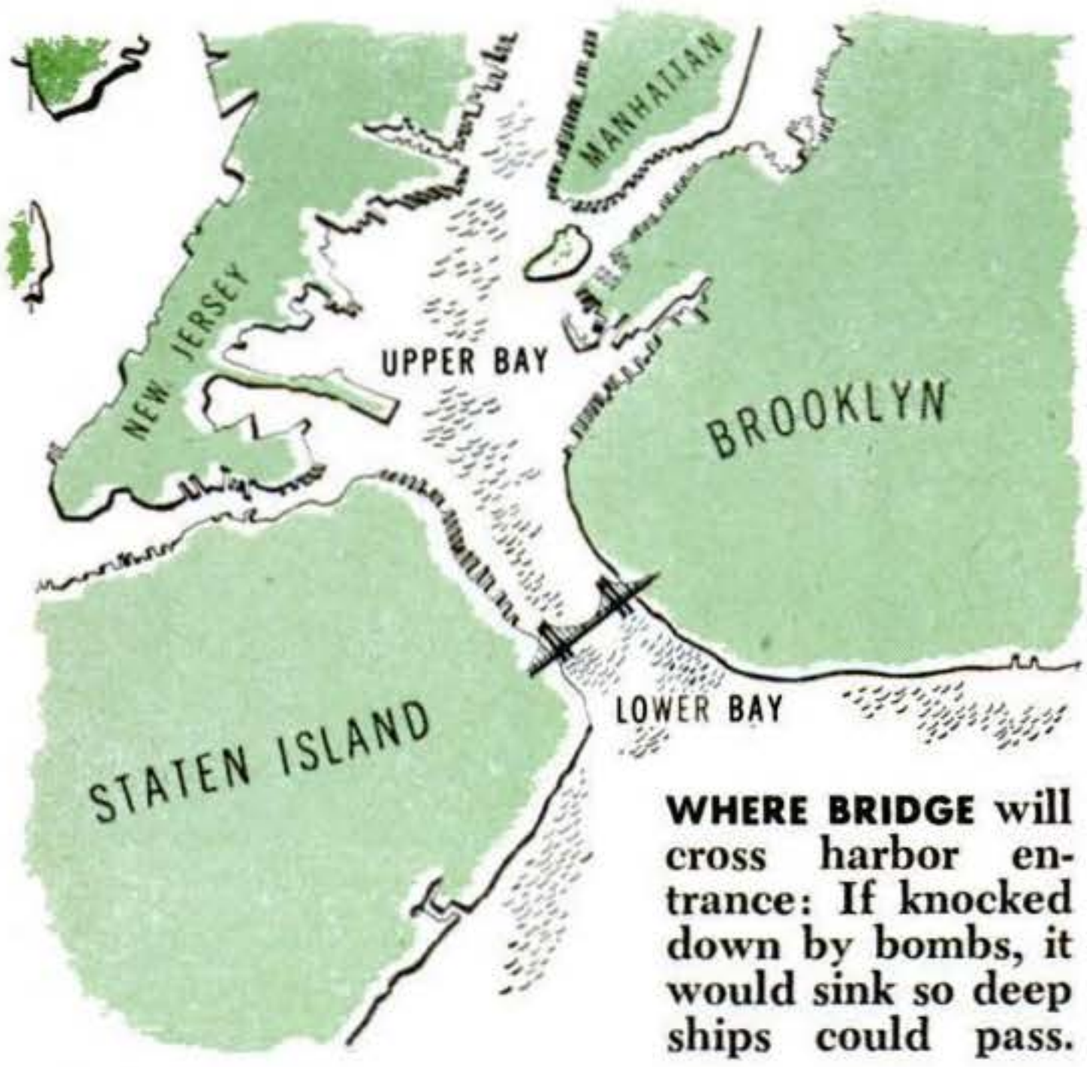


How world's longest suspension bridge will frame New York harbor is shown in drawing.

Biggest Bridge to

Multimillion-dollar aluminum rainbow will stretch above ships at New York's harbor entrance.

By Gardner Soule



WHERE BRIDGE will cross harbor entrance: If knocked down by bombs, it would sink so deep ships could pass.

ONLY one of the world's great harbor entrances has been bridged: San Francisco's Golden Gate. Now, after a hundred years of talk and dreaming, another harbor mouth is to have a bridge across it: New York's.

"The Narrows," says John M. Kyle, chief engineer for the Port of New York Authority, "has always been one of the great challenges to bridge-builders. It is a place for one of the great crossings."

The Narrows is a three-mile-long bottleneck of salt water between Brooklyn and Staten Island. It is the mouth of the Hudson River. More than a mile wide and 100 feet deep, it is the only entrance for big ships to New York's vast bay. Its ship channel, 2,000 feet wide, carries trade far richer than the fabled wealth of the Indies—in some years one-fourth of all the imports and exports of the U.S. To overpass it, Mr. Kyle and his people plan, between now

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Between anchorages, bridge will stretch 7,200 feet; center span will be 4,400 feet long.

Span Busiest Harbor

and 1960, to erect a crossing that:

- Will be the first thing in America seen by passengers coming in on the great ocean liners.
- Will have the world's longest suspension span at its center (4,400 feet vs. 4,200 of the Golden Gate, present record holder).
- Will be 237 feet above the water at mid-channel: far above all commercial and naval ships.
- Will have two decks of six auto lanes apiece (only the bottom deck will be opened at first).
- Will carry, it is estimated, 14,500,000 vehicles in 1960, increasing up to 48,000,000 in 1977.
- Will cost more than any other bridge ever: 220 million dollars.

"You couldn't," says Mr. Kyle, "have a second-rate bridge here."

John (Jack) Kyle, 50, is a man of steel-blue eyes; sharp, keen features; and sandy hair—what's left of it—turning gray.

"People wonder," he muses, "why the Narrows and other harbor entrances have not been bridged. The answer is we didn't know how. The George Washing-

PORT AUTHORITY helicopter, equipped with pontoons, will carry Chief Engineer Kyle (left in bubble) and others from their offices to site of bridge during years of construction.

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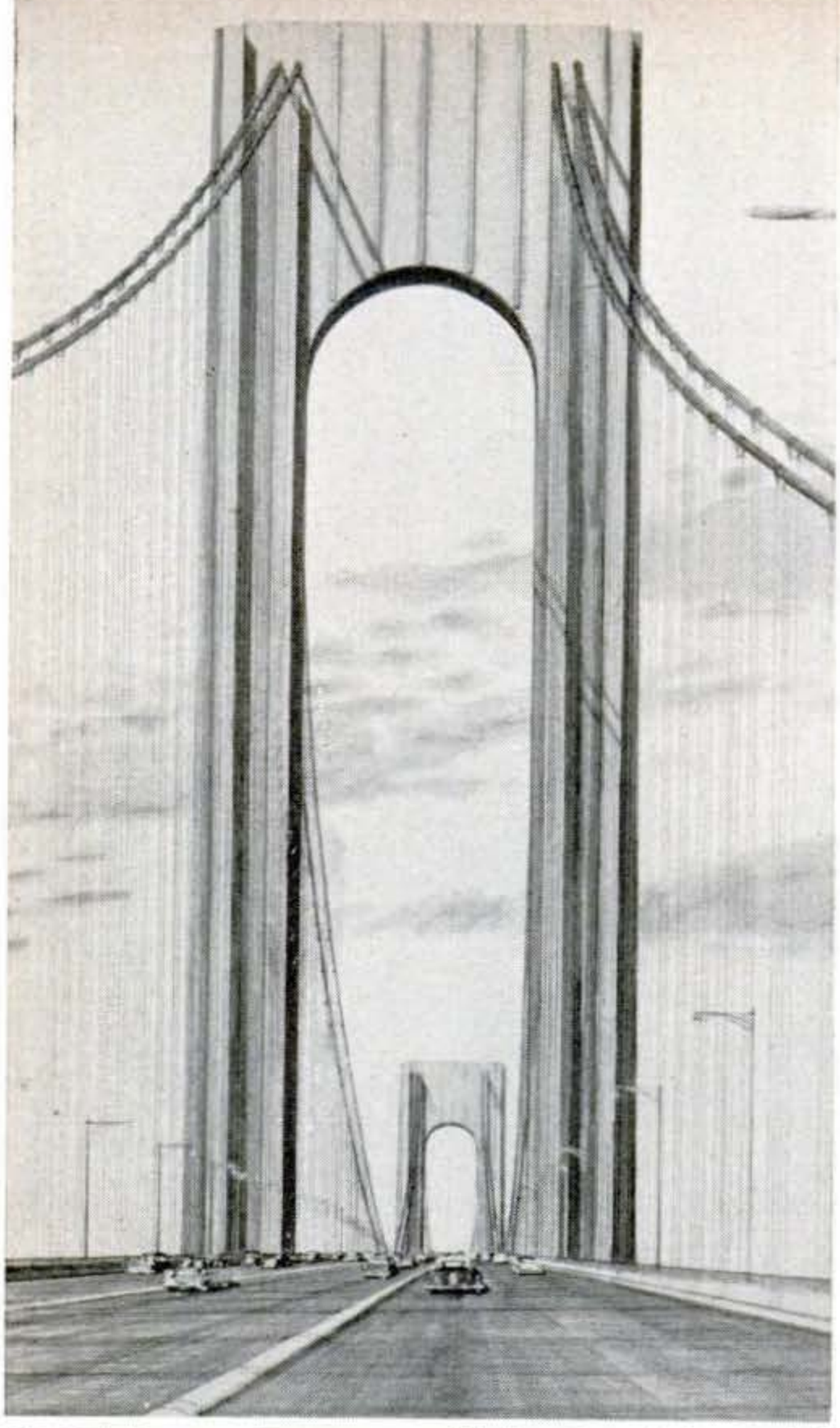

SPECTACULAR TOWERS will be faced by solid steel—not concrete. Upper road is planned by designer O. H. Ammann for passenger cars only. It is wide enough for three lanes each way.

CONNECTING HIGHWAYS will cost about 39 million dollars on Brooklyn side (shown), 35 million in Staten Island. Express roads across New York City will run from bridge.

ton Bridge was the first long-span suspension bridge ever built. Then, in 1937, came the Golden Gate. These two bridges panned out, and engineers began to feel they knew how to do it.

"But it still isn't simple. Know what an ironworker said to me the other day? He said, 'If only people could come along with us when we build a bridge and see what we do, they'd never kick about toll.'

"We'll give you a quickie on how we propose to build the Narrows Bridge."

Construction will be done by the Port Authority under an agreement with the Triborough Bridge and Tunnel Authority.

For the foundations two large excavations will be dredged out of the sand on the bottom of the bay. Then a 230-by-100-foot concrete-and-steel caisson will be nudged by tugboats into place over each hole and sunk until only the top edges of its walls remain above the surface. Each caisson then will be sealed to the bottom by concrete, and all water pumped out.

When the Golden Gate bridge was being built, engineers tried to haul a smaller caisson into position. They got caught by high waves, the caisson battered a concrete wall, and had to be towed out to sea, scrapped and sunk. But one failure doesn't end a method in bridge-building.

"We could have trouble with an unanchored caisson in our exposed location (the Narrows is next door to the open sea)," says Mr. Kyle, "but I think we're in a good place for caisson work."

In an emergency, while the Narrows Bridge is being built, Jack Kyle will be on call. He will leave his office, on the 11th floor of a downtown New York office building, and push the "up" elevator button—not "down." He will ride up to the roof, step onto a steel landing platform, and enter one of the New York Port Authority's two helicopters. The copter will take him to the Narrows Bridge site, where it can land on pontoons. "It saves an awful lot of climbing," he says, "and you see a lot from a helicopter you don't see otherwise."

Helicopters are the way he gets from

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his office now to the 17 famous, giant installations he is, as chief engineer for the Port Authority, currently maintaining or building. These include the Lincoln Tunnel (its third tube is now being built), New York's International Airport (being built while it is used for 500 flights a day), and the George Washington Bridge (currently, rebuilding the toll plaza; soon a lower deck may be added).

After caissons are in place for the Narrows Bridge, 150-ton, 250-foot steel H-piles will be driven through the bottom of each one until they anchor in the solid rock 325 feet beneath the surface of the bay. This will be the deepest any bridge pier has ever gone to reach rock.

Next, the towers will be built atop the foundations. This is a job of erecting structural steel, as in the case of any skyscraper. The Narrows 681-foot towers will be the tallest structures in the U.S. except for a few skyscrapers and the Golden Gate Bridge towers. Outside the U.S., only the Eiffel Tower in Paris will be higher.

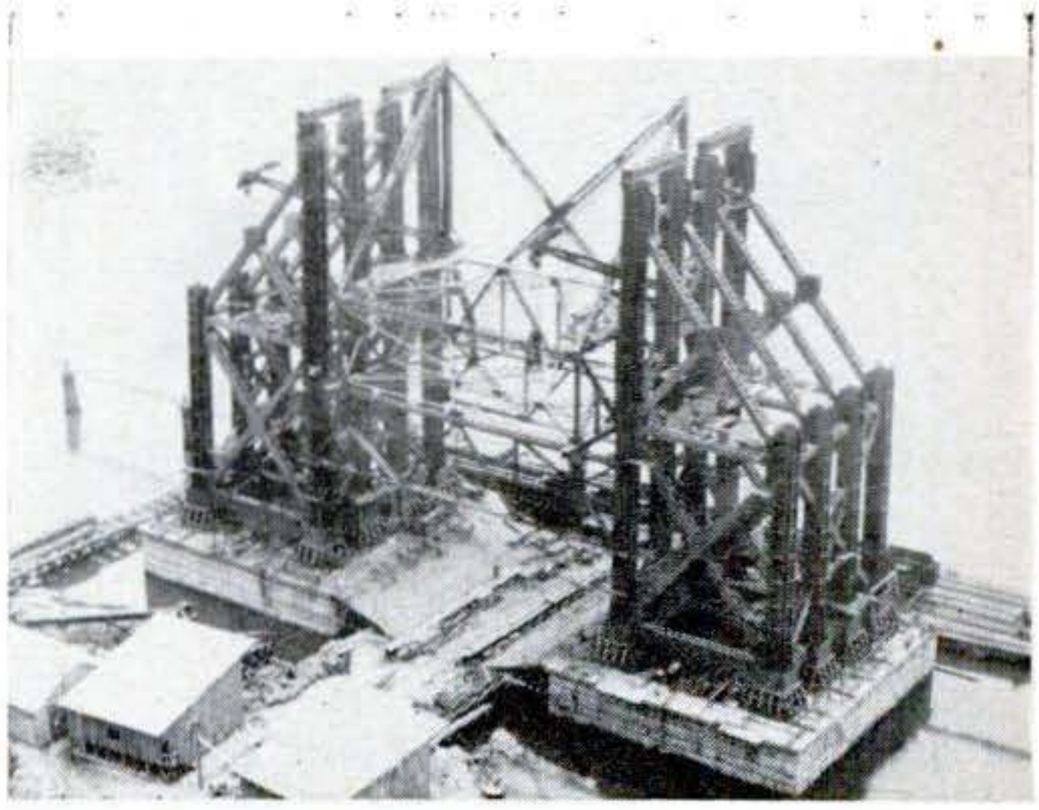
Mr. Kyle's assistant, H. George Decancq (pronounced Doo-cane), is an authority on such work, having crawled over every inch of the George Washington Bridge while it was being built, and he interjected at this point: "There is a skill in this business: It consists of not being afraid of heights.

"For instance, at every step as the Narrows Bridge's towers go up, someone has to walk out onto the ends of steel beams, look down to the foundations or barges beneath, and signal the men below. If," he commented, "a man is not conditioned to the heights, he can't work there. You can't train a man to it. What happens is a man grows with the job, and therefore is not leery at several hundred feet up."

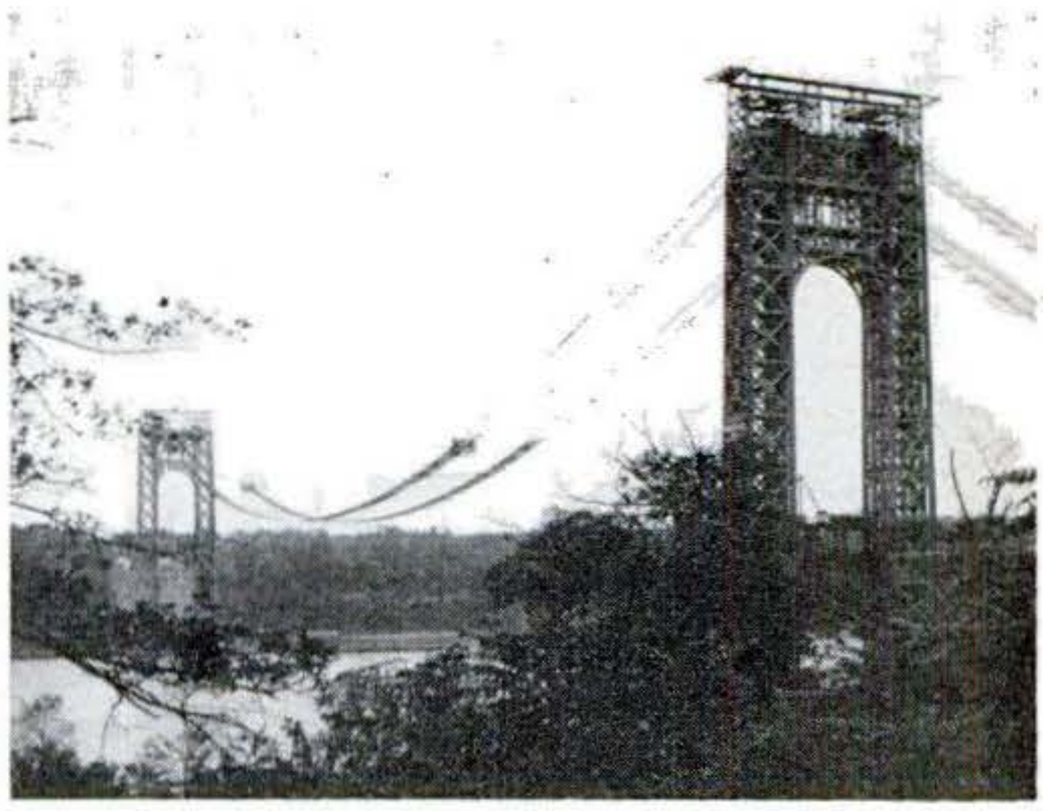
The Narrows towers will be a new kind: They will be of steel plates, not lattice work as on many bridges. The smooth outside wall of each tower will be steel. No concrete facing will be used. The inside of each tower will be a honeycomb of 3½-foot-wide manholes, each

[Continued on page 264]

Here's how they build a great suspension bridge



AFTER FOUNDATIONS are sunk in water, towers go up. George Washington Bridge, finished in 1931 and shown in these three photos, taught engineers how to build long suspension spans.



CABLES are laid across river bed, raised by crane to towers. Catwalks are built from center back toward towers. Workers travel out in mechanical carriages running on cables.

GREAT SUSPENSION CABLES are finished by workers on catwalks. Cables hanging down from them support road. Cranes (center) atop roadway that is in place hoist up next section.

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STRAPS LASH test pilot Johnston's feet to deck before he takes off in the flying platform.

It takes one minute to learn to fly the

"SURE I'd let my kids fly it," says Phil Johnston, first man to take the Navy's new flying pie pan aloft. "It's no trick at all. Anyone can take it up after a minute's instruction."

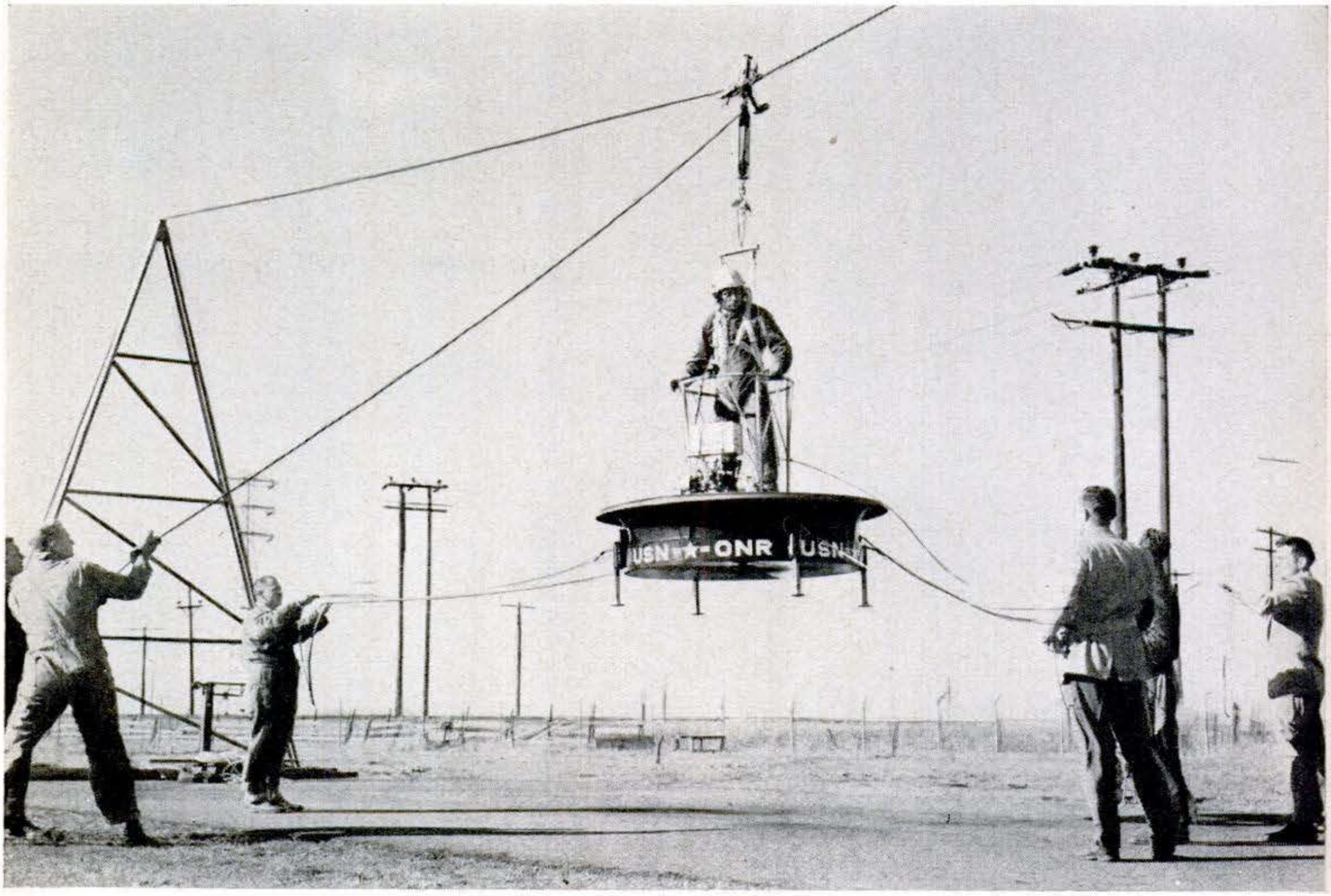
Once the round platform is up in the air, the pilot steers it by simply shifting his weight, leaning in the direction he wants to go.

The novel contraption uses an unusual principle of lift and propulsion—the ducted fan. Two opposite-rotating fans, installed horizontally inside the platform, suck in air through holes, and then thrust it downward with great force, creating lift. Power is supplied by two engines developing 100 horsepower together.

The flying platform was developed and built by Hiller Helicopters, Palo Alto, Calif., as a research tool for the Office of Naval Research. The company's youthful president, Stanley Hiller, visualizes his vehicle as a military personnel carrier, with larger models carrying guns, tanks and supplies over tough terrain.

One problem to be solved is a means of emergency letdown. Right now, if either of the engines were to fail, the thing would fall like a brick. When that is overcome, pie-pan commuting from back yard to office may be a possibility.

During the test hops before free flight, the pie pan was harnessed to supporting cables.



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Flying Pie Pan

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California's "radiation fleet" consists of 105 trailers and 16 mobile labs like those above.

Cars Set to Warn of H-Bomb Fall-Out

READY to race into action if H-bombs should fall in California, more than 100 trailers and trucks would chart radioactive fall-out, to guide rescue and relief operations. California's Office of Civil Defense developed the monitoring vehicles.

A pioneering study of its own, made before the recent revelations of H-bomb fall-out peril, forewarned that radioactivity might contaminate 10 to 20 percent of the state's area.

MOBILE LABS test radioactive contamination in food, water and air. Technician is making preliminary check of liquid sample in bottle with Geiger counter. "Glove box" at left in foreground, used in preparing samples, confines contamination. Lab has three-man crew, with driver doubling as radioman, and carries its own power plant and supply of fresh water.

TRAILERS, ready at strategic spots throughout California, serve trained 20-man squads with top-priority mission of charting extent and intensity of fall-out. They carry Geiger counters, ionization chambers and respirators. Handie-talkies and longer-range radio provide communication among squad members and with the 11 State Civil Defense control centers.

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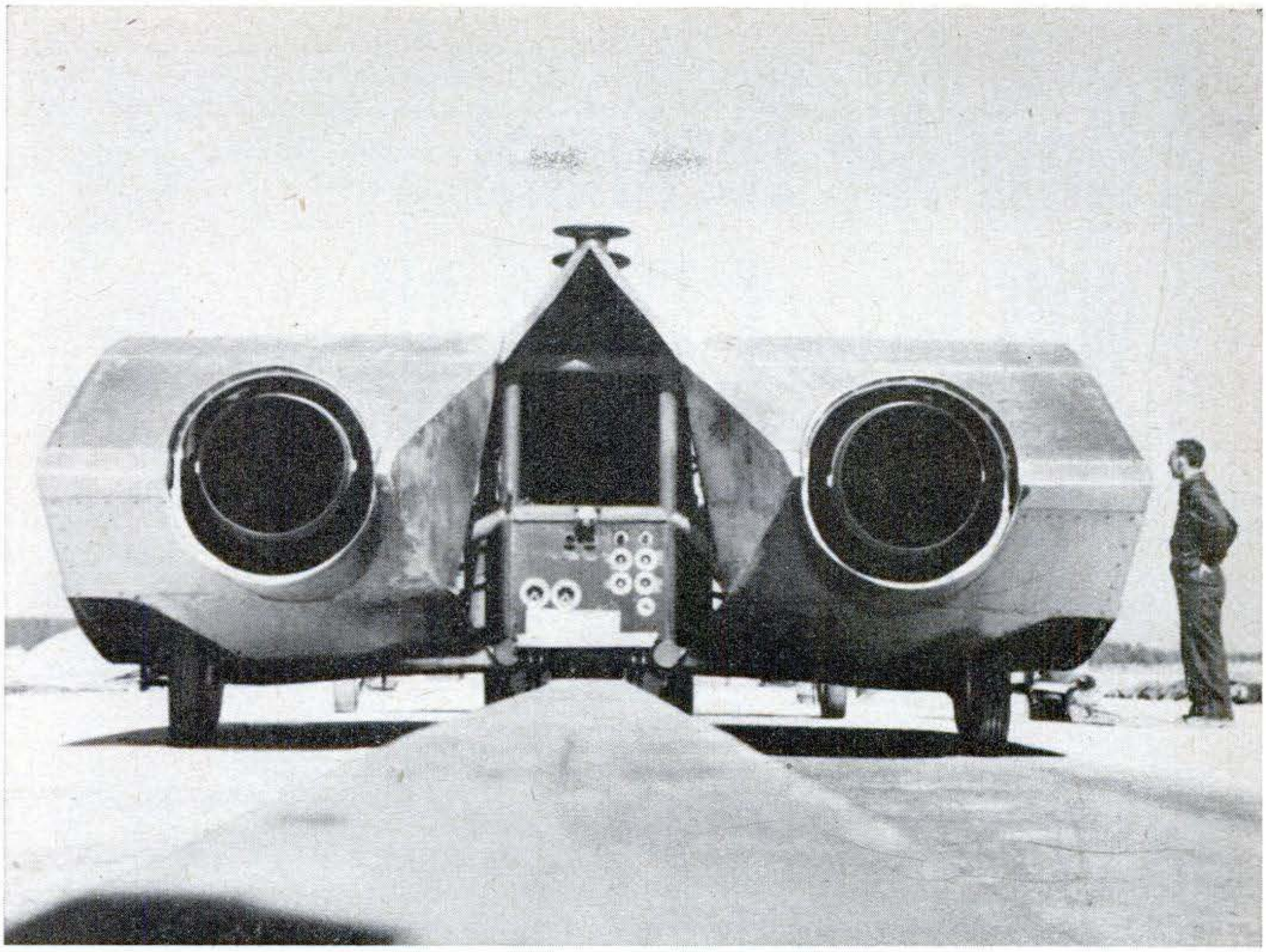

Twin-Jet "Monorail" Tests Airplane Arresting Gear

WITH this odd-looking vehicle, All American engineers test plane-arresting gear. Straddling an I-beam, it gives a jet-powered shove to a cart loaded with steel plates. Near the end of a mile run the concrete beam widens to brake the twin-jet car. The dead load rolls on and slams into the arresting gear with the speed of a landing plane.

They Said Then...

"The automobile will have an important place in the future but will not seriously affect the sale of vehicles."—THE SPOKESMAN, 1905.

"What has been observed at the recent automobile shows leads to the supposition that finality in motor car chassis design has at last been reached."—CYCLE AND AUTOMOBILE TRADE JOURNAL, 1908.

"If I had my way I would make it a crime to use automobiles on the public highways, because no man has a right to use a vehicle . . . that is dangerous . . . Perhaps the time will come when horses will . . . not be afraid of automobiles; but I doubt that, for I have not seen the time yet that I was not afraid of them"—JOSEPH W. BAILEY, U.S. SENATOR FROM TEXAS, 1909.

They Say Now...

". . . The automobile dealer is one of the largest independent merchants."—F. L. HASTINGS, IN NATIONAL AUTOMOBILE DEALERS ASSN. MAGAZINE.

"The annual model change has been the most important single factor responsible for the growth and vitality of our industry."—HARLOW H. CURTICE, PRESIDENT, GENERAL MOTORS.

"The new expressways . . . actually require the maintenance of a uniform speed of 60 or 70 m.p.h. . . . On such roads the only danger is boredom. . . . It seems perfectly possible that a radio may be considered an essential safety device, and a few exciting 'westerns' may reduce the accident toll on hot afternoons."—MAURICE OLLEY, DIRECTOR OF RESEARCH AND DEVELOPMENT, CHEVROLET.

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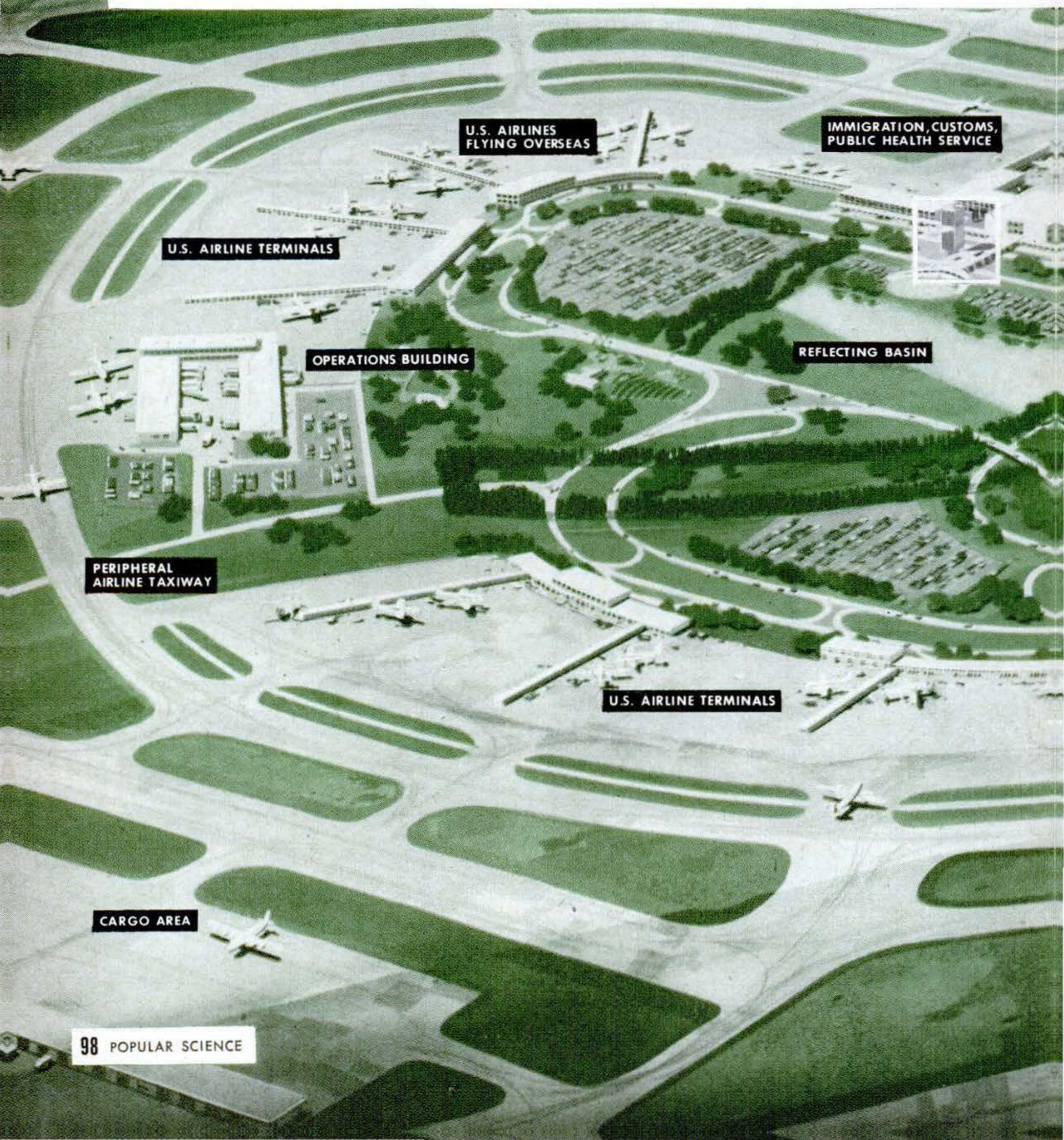
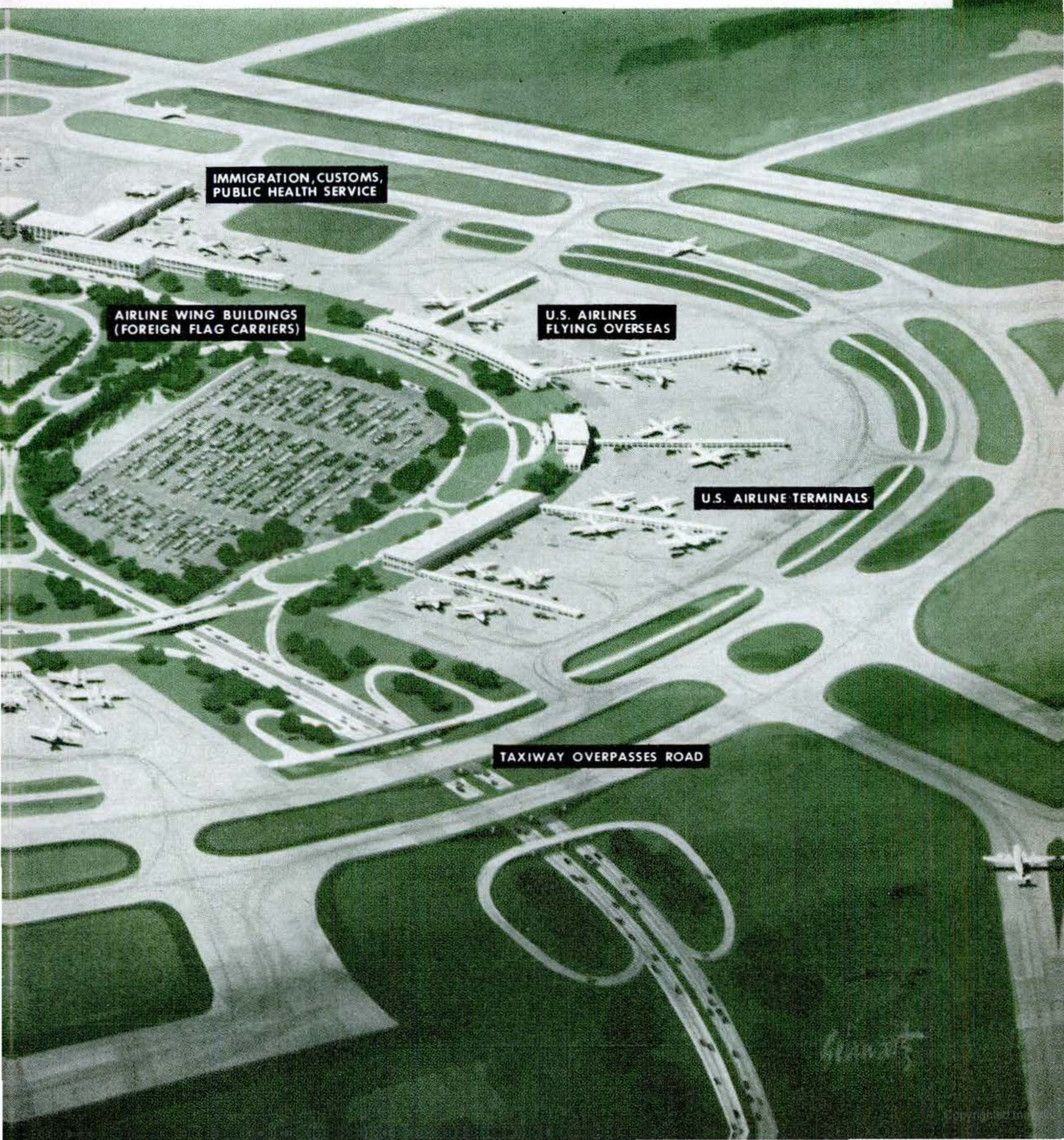
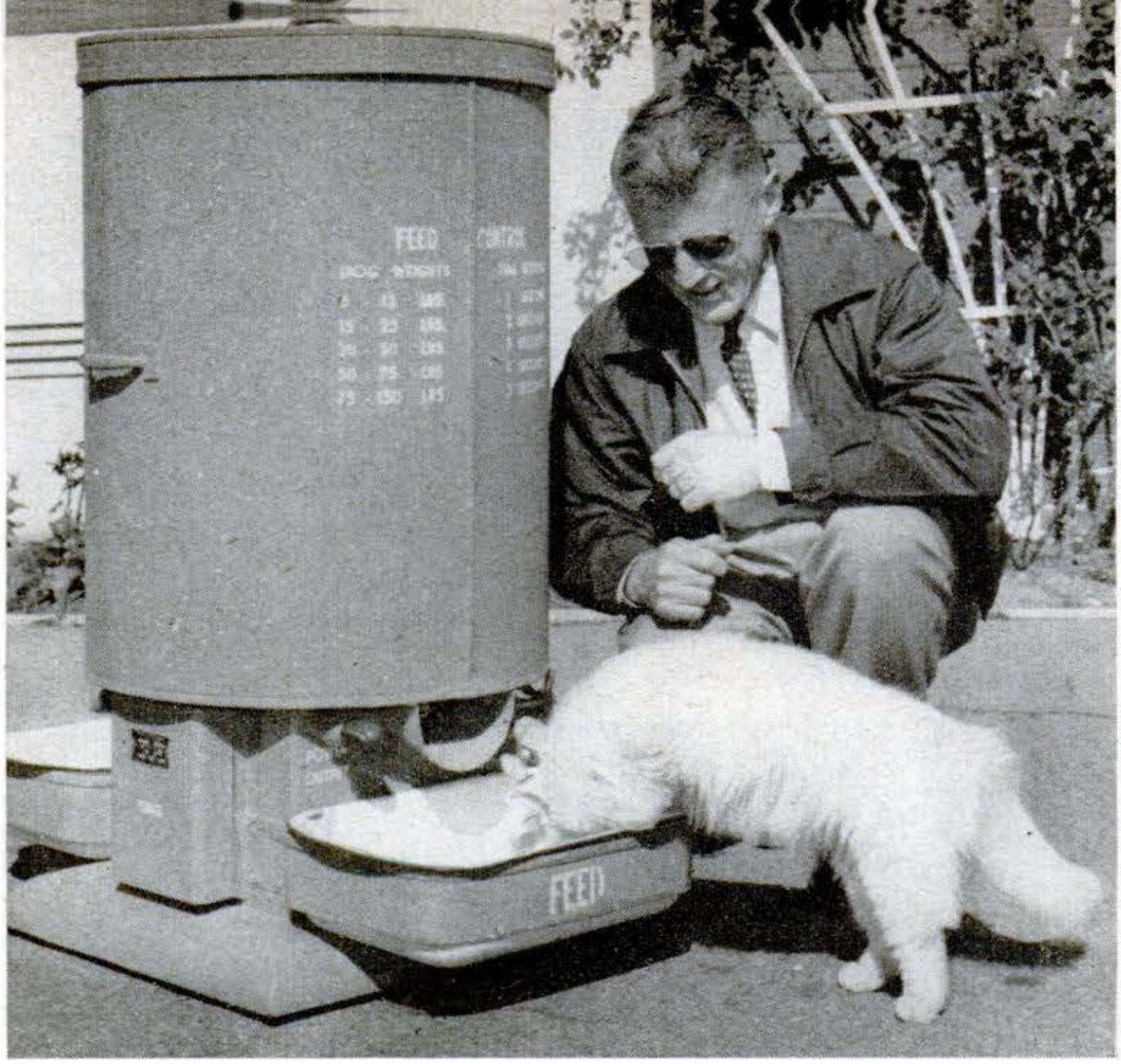
New Air Terminal Will Dwarf Them All



A $60,000,000 Terminal City planned for New York International Airport is shown in this artist's drawing. When finished, it will be the world's largest passenger terminal.

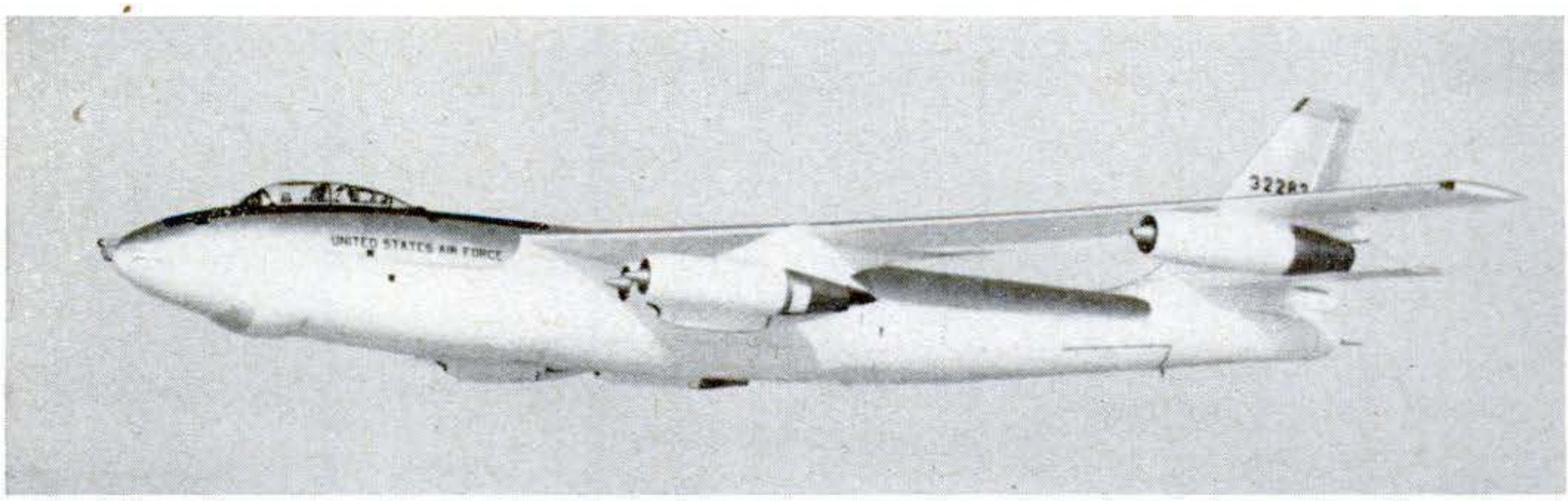
The new 655-acre development, set in the 5,070-acre airport, is expected to serve 8,500,000 air travelers annually by 1965. Each of the major airlines will have its own terminal building. Combined, they will be able to handle 140 four-engine airplanes at one time, compared with 29 now. Fifty acres of parking lots will accommodate 6,000 cars. Rising above the half-mile-long International Arrival Building will be the 11-story control tower shown in the sketch at left and also in the white box just below it.





Pet Cafeteria Lets Animal Feed Himself

BOARDING a pet with the vet while you are away is expensive. Instead, the automatic machine at left allows dogs and cats to feed themselves for as long as 10 days. Inventor Bernie Bergevin, Palos Verdes, Calif., says the electric device measures food, adds water and mixes them. On the other side is a water tank that keeps a drinking dish always full.



White Bomber Bottoms Protect Crewmen from Heat of A-Blasts

EVEN when flying high above an A-bomb blast, radiated heat is a hazard to the crew of a bomber like this B-47 Stratojet. As a protective measure, the underside is painted with a reflective finish. The B-52 and B-36 bombers are similarly treated.

Big Truck Has Tandem-Turn Front Wheels

FOUR wheels, two on each side, turn in steering this new tractor unit developed by the Pacific Intermountain Express. Other features are air-suspension springs and engine location midway under the chassis instead of under the driver.

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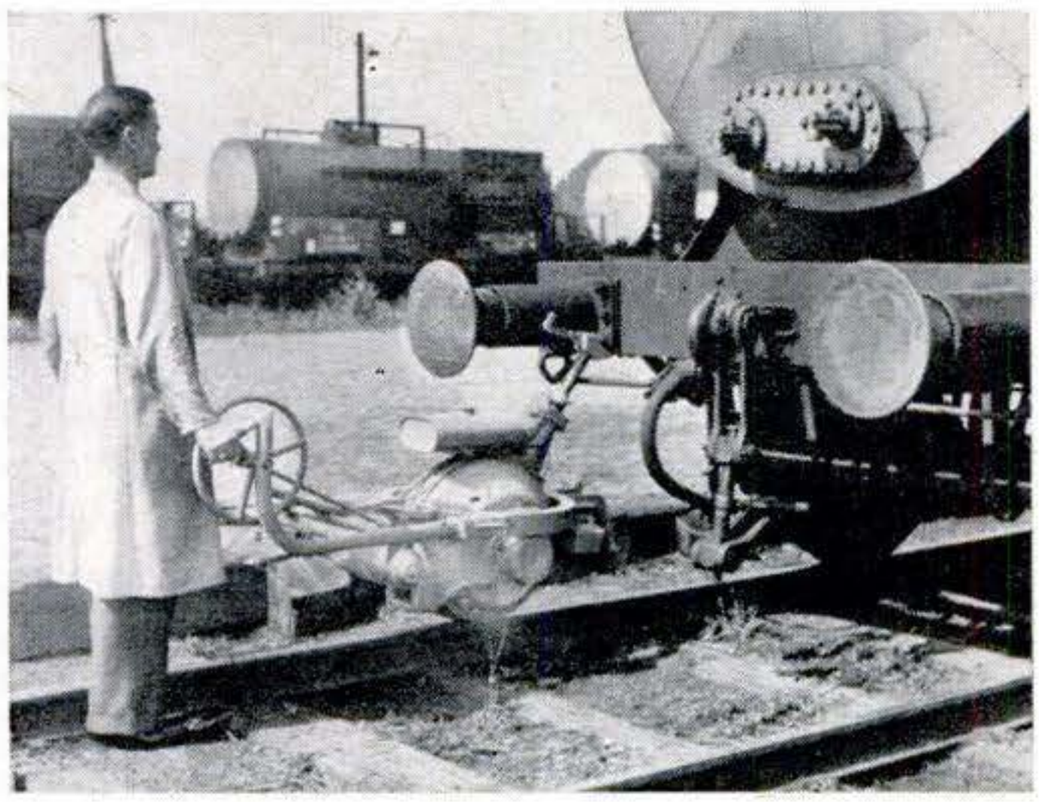
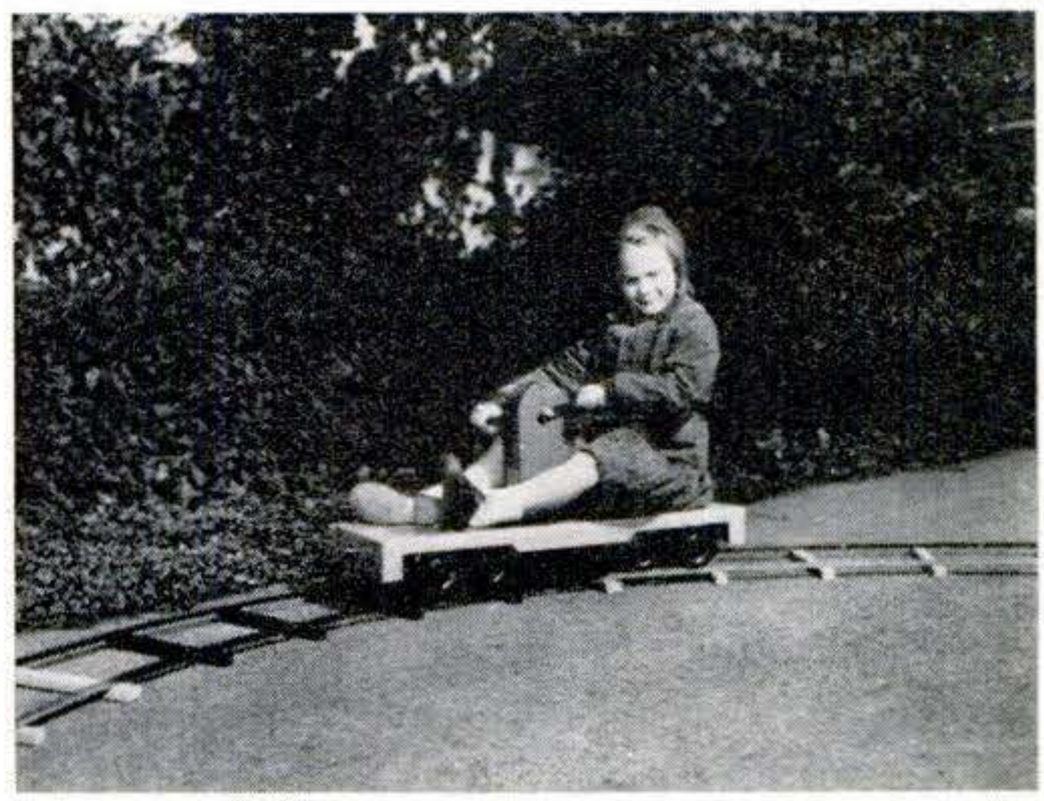
Monster Tank Mounts Wheels for Haul to Arabian Refinery

ASHORE on a Persian Gulf beach in Saudi Arabia after a sea voyage from Holland, this 200-ton cylinder is about to start its overland journey to the Ras Tanura refinery of the Arabian American Oil Co. The 114-foot-long tank, measuring more than 16 feet in diameter, will be used to convert low-octane naphthas to high-octane gasoline.



One-Wheeler Shunts Box Cars

RESEMBLING a power mower, this six-hp. gasoline dolly enables one man to move freight cars weighing up to 100 tons. With its single wheel riding a rail, it is used in Germany to switch cars at stations, yards and on private factory sidings.



Junior Railroad Fits Back Yard

A HAND-OPERATED car whips the kids around the track of this toy, making a railroad center out of any 12-foot-square yard. The crank turns a rear-wheel chain drive on the Yardbird, made by Charles William Doepke Mfg. Co., Rossmoyne, Ohio.

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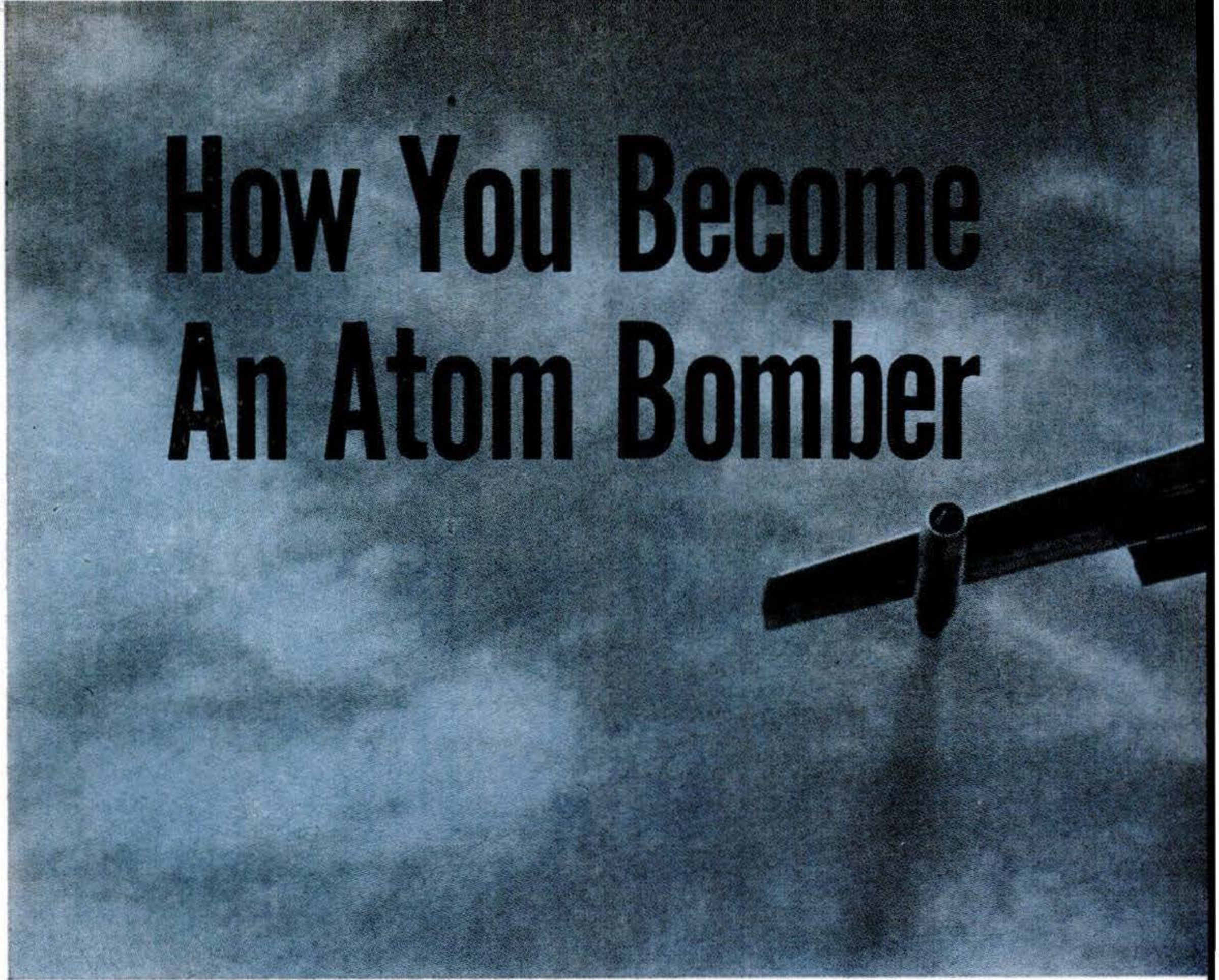
How You Become An Atom Bomber



Our toughest flying school graduates Three men trained to deliver

By Devon Francis
PHOTOS BY W. W. MORRIS

ON THE windy flatlands of Kansas, a new addition was made a few weeks ago to America's far-flung Strategic Air Command: the 1,000th crew trained to fly a great jet airplane in anger across oceans and the polar regions.

An airplane like this contains a single shackle—a single anchorage—for a single bomb. Its crew consists of only three men, armed with the explosive atom.

As with the fliers who preceded them, the 1,000th crew had been through the toughest schooling in the U.S. Air Force. That's because flying at 500 miles an hour in the frigid temperatures above 40,000 feet is tough. It's because the SAC's planes, B-47 six-engine bombers, are almost deliriously complicated.

An airplane commander, his co-pilot and a navigator-bombardier constitute a crew. They are select men. Only the princes of the USAF flying fraternity are chosen for schooling in B-47s at the McConnell Air Force Base near Wichita.

Most of the "students" are veteran fliers. Many have been pilots or co-pilots of propeller-driven B-29s, the "very heavy" bombers of World War II. Yet their reaction to a first ride in a B-47 is invariably the same:

"Things happen too fast! There's too much to do!"

Even before an engine can be turned

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the 1,000th B-47 crew: one bomb anywhere in the world

over, the airplane commander and his co-pilot must check 231 items. The co-pilot reads off the list:

"Controls."

The A. C. answers, "Engaged."

"Fire shutoff switches."

"Depressed."

"Low-speed warning."

"On."

"Anti-skid."

"On, light out." And on and on . . .

The navigator-bombardier has his own preflight check list. After the engines are started and the airplane has taxied to the lip of the runway, there is a pre-take-off check list.

Then there is an after-take-off check list, a before-descent check list, a before-

MEAGER THREE-MAN CREW of B-47 is in training for two months. Each day some 35 of these big instruction bombers wing aloft at Wichita on flights of four hours' duration.

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BIG BOMB BAY can be opened and clapped shut in seconds. In background are steerable forward set of wheels in "bicycle" landing gear. Outriggers steady the plane laterally.

A 10-CENT NYLON CORD, held here by Maj. Nils B. Jensen of training staff, is attached to plane's skin just ahead of the cockpit to indicate strength of side winds in landing.

landing check list and an after-landing check list.

Strictly by the book is the way a B-47 is flown. It has to be. If a pilot misses an approach to a landing and has to "go around" for another try, he has to consult his charts. He burns 1,500 pounds of fuel in the extra four minutes of the go-around, and that changes his landing, or "flare," speed. Flare speed can vary from 115 to 150 knots (130 to 180 miles an hour) depending on weight.

The incredible volume of kerosene devoured by the B-47's jet engines supplies no end of problems that classroom instructors propound to the indoctrinees.

"Suppose," they are told, "that all your electric fuel gauges go out. You don't know the amount of fuel you have left in your tanks, and consequently the weight of your airplane. What do you have to do before you can land?"

The answer is like nothing they have ever heard before: High in the air, at a given throttle setting, the pilot must pull his steed into an incipient stall. The entire airplane—more than 90 tons of it, fully loaded—starts to shudder.

"So," concludes the instructor, "you read off your knots on your air-speed indicator at stall and look on your chart to see what gross weight will bring on a stall at that speed."

Even so, the students have a rugged time. A fence at the approach end of one runway finally had to be torn down because so many students misjudged their height and speed and dragged their wheels through it.

The potential commanders in training at Wichita, the only Air Force base of its kind, are an apt lot. They are career men. Flying will be their entire professional life until they retire. Their average age is 34. Most of them have been in combat in World War II, or in Korea, or both. Most hold the rank of major. The Air Force doesn't cotton to entrusting a $2,500,000 airplane to a throttle-happy fly-boy.

Maj. Emory C. Morgan, just graduated under the Air Training Command's program at McConnell, was a typical student commander. A native of Weatherford, Tex., he fought in North Africa, Italy, Sicily and Sardinia as a P-38 pilot. He is a graduate of the University of Southern California and holds a master's degree in personnel administration from George Washington University. He is married and has two children.

He loves to hunt. In three years as assistant air attache, after the war, in the U. S. Embassy at Pretoria, Union of South Africa, he bagged everything from leopards to elephants.

His co-pilot is Lt. John F. Strank, a farm boy from South Fork, Pa. He is 25, married and the father of an eight-month-old son. He co-piloted B-29s on Okinawa after the Korean war.

Of the B-47's three-man crew—a sharp

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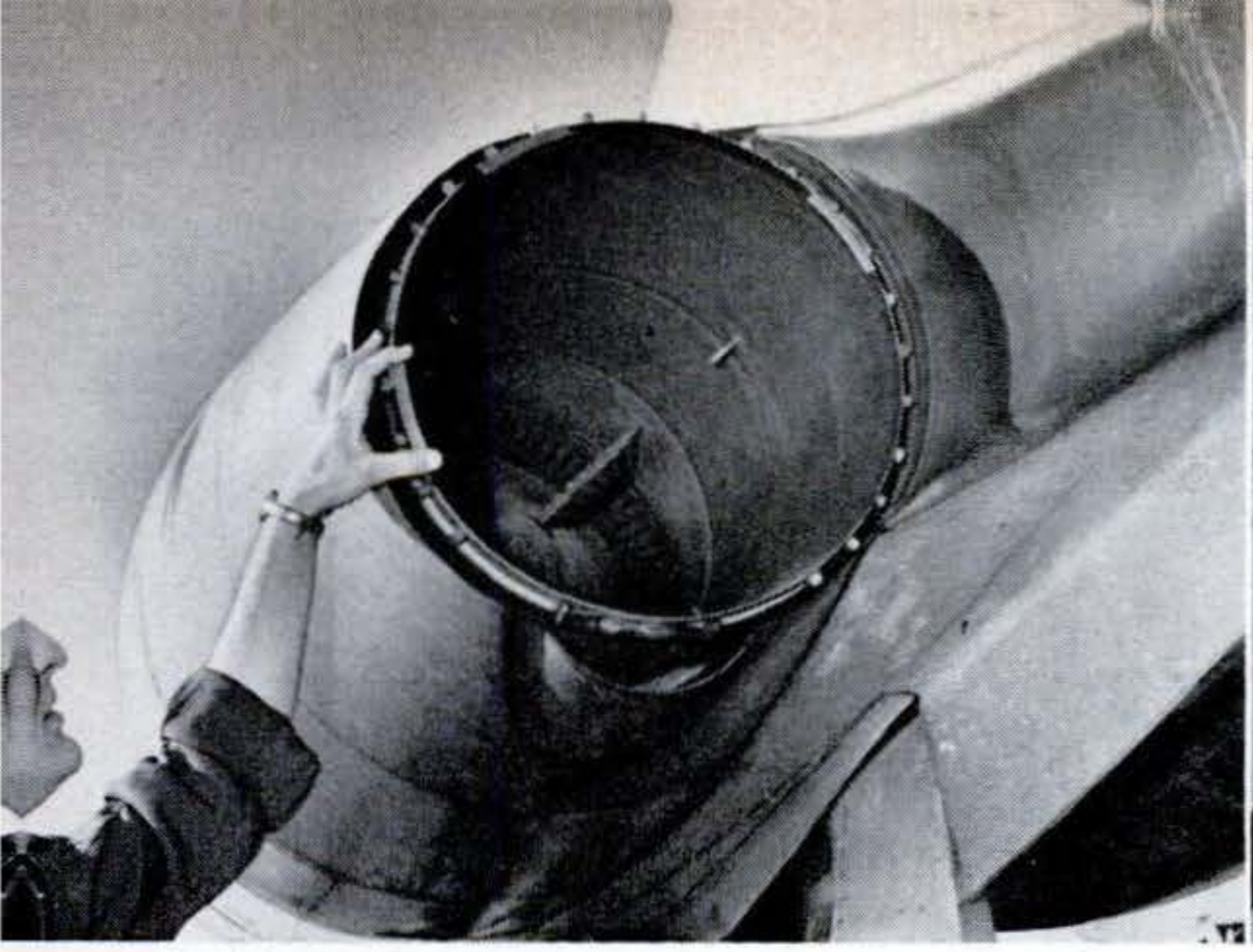
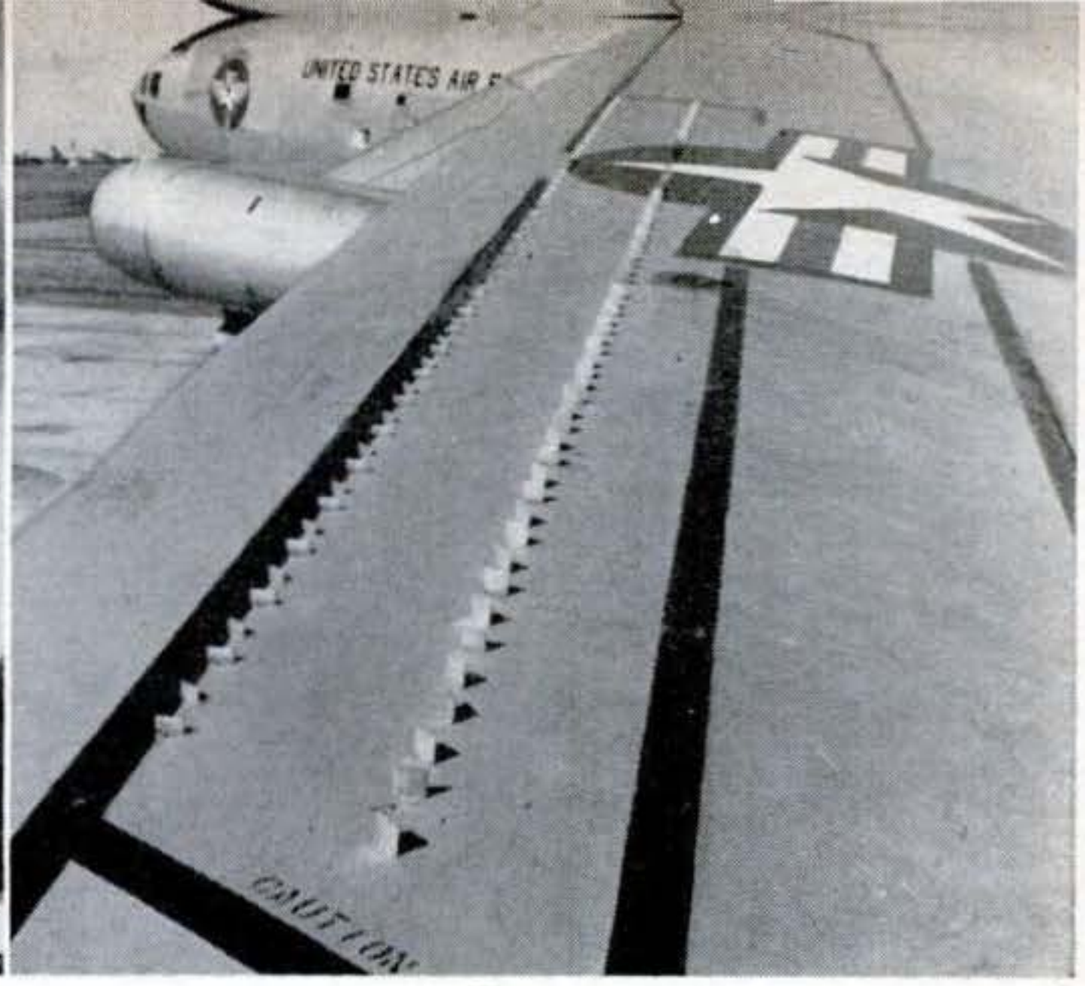
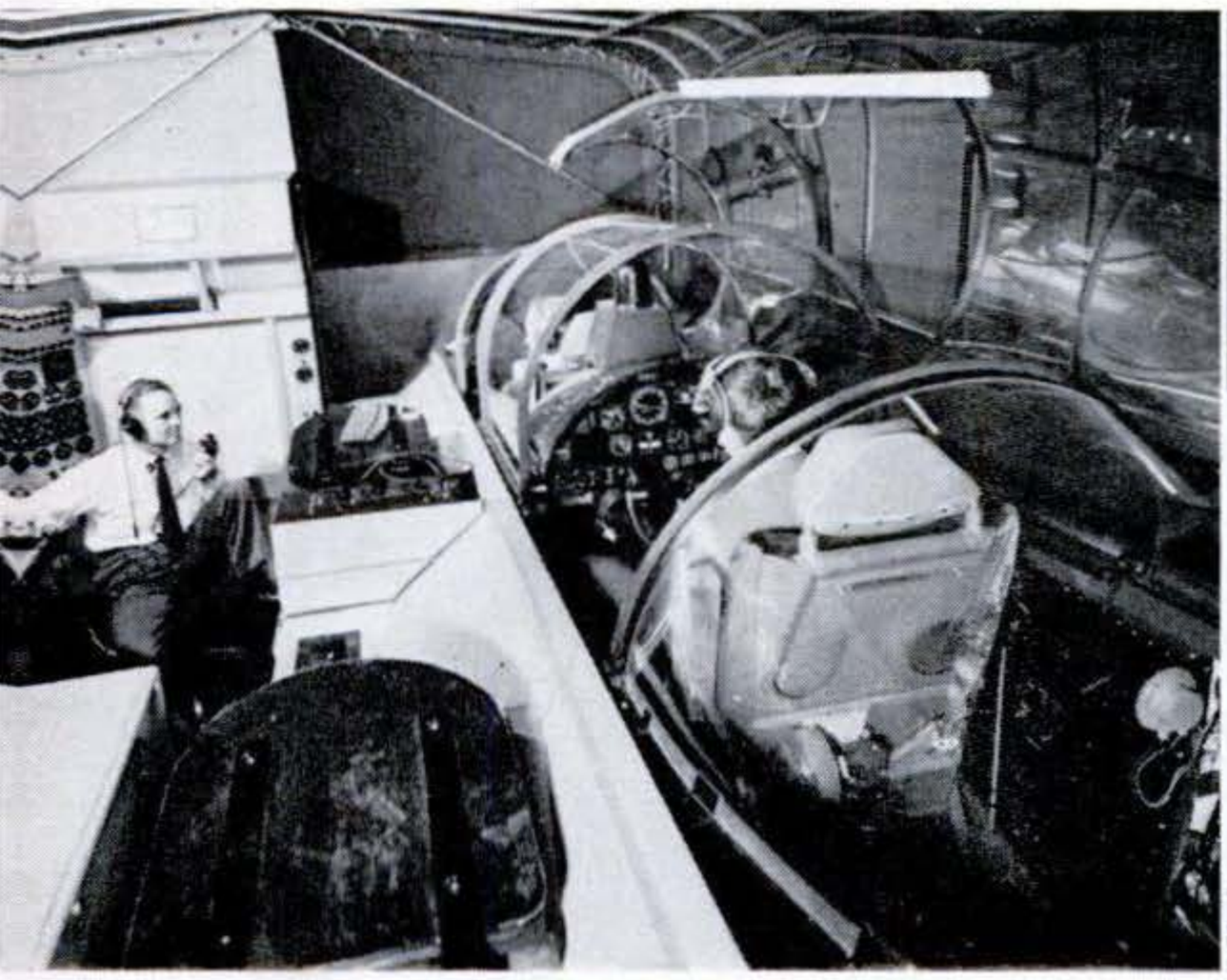


TAILPIPE GAS VELOCITIES are matched for six engines by bolting metal strips to lips. Co-pilot Strank, left, is cousin of the Marine squad leader who raised U.S. flag on Iwo Jima.



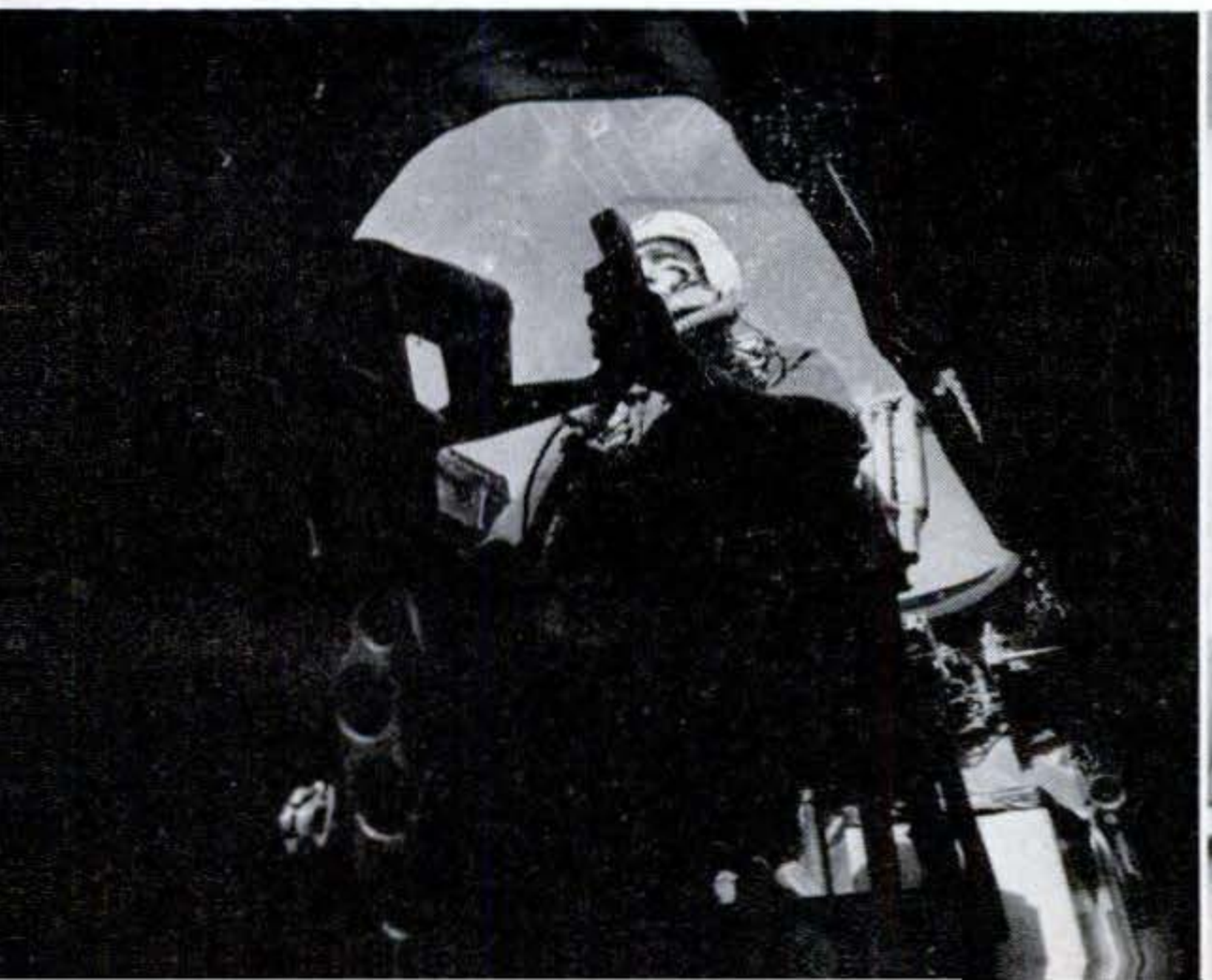
BITS OF METAL, called vortex generators, are anchored in top of wing, outboard, to direct the flow of air at low speed and insure aileron control for take-offs and landings.



FLIGHT SIMULATOR duplicates B-47's controls. Training group commander is Col. John E. Atkinson. Commanding 3520th Combat Crew Training Wing is Col. L. C. Coddington.

CREW CLOSES DOOR, aft in belly, that houses plane's ribbon parachute. 'Chute, 26 feet in diameter, is "popped" with cockpit control to shorten the bomber's landing run.

PILOT AND CO-PILOT sit in tandem under plastic canopy high in plane. Navigator-bombardier is forward in nose. Picture was taken from a narrow walkway near loading door.



FIRST TRAINING FLIGHT is called "the dollar ride." Student Morgan, left, hands Instructor Willis an inscribed dollar bill as memento. Ladder leads to plane's entryway.

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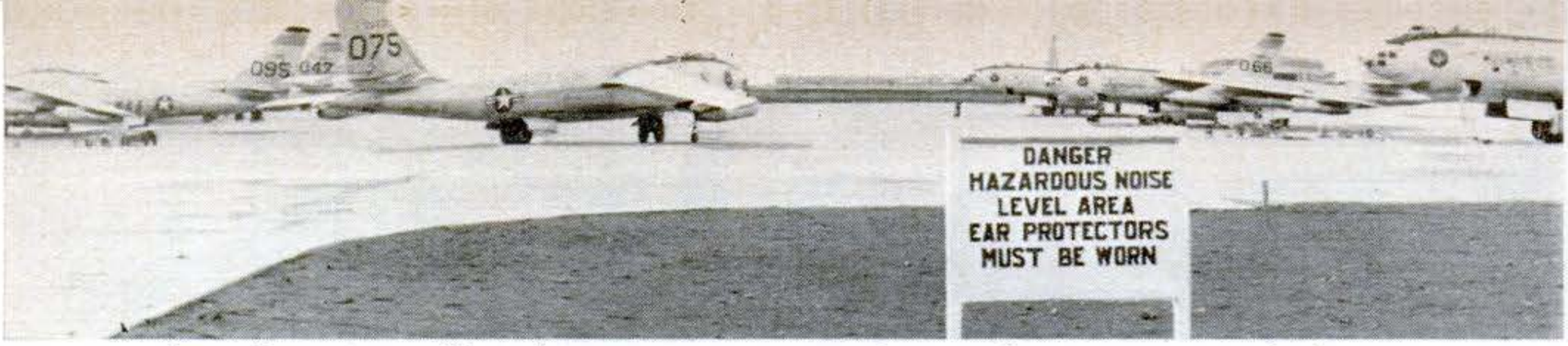

Sign at edge of McConnell parking apron warns of ear-splitting roar made by jet engines.

contrast to the 12-man crew of a B-29 and the 15-man crew of the behemoth B-36—commander and co-pilot are regarded as an inseparable team. Morgan and Strank are stationed at the Altus Air Force Base, in Oklahoma, with Strategic Air Command's 96th Bomb Wing (Medium).

During their stay at McConnell, their training was the responsibility of Capt. Charles Edwin Willis. He is a nerveless, chunky little guy who never raises his voice. He talks mostly in monosyllables. His face seldom changes expression. He only says, in a critical decision, "Now, what you do in a case like this is—"

The other day he was demonstrating something to a student in a B-47 as they cruised along at an altitude of 35,000 feet. Willis had previously had his student put the flaps down. Those are the things at the trailing edge of the great, swept-back wing that roll out at take-off and landing to increase the lift. Suddenly the student exclaimed on the interphone, "The flaps won't retract!"

"That's no sweat," Willis soothed him. "They froze. Now, what you do in a case like this is fly down to where it's warmer, and the ice will melt."

They did, and it did.

On one mission in World War II, Willis lost his elevator to flak. The elevator is the control that makes an airplane go up and down. By calmly experimenting while his bomber threatened to pitch itself into a last dive, he discovered that he could retain marginal control with his flaps and throttles.

"I'm riding this thing home," Willis drawled to his crew. "If anybody wants to bail out, do it now."

Nobody jumped. Willis nursed his bomber back to an emergency strip and plastered it on at 180 miles an hour, twice the normal landing speed. The feat earned him the Distinguished Flying Cross.

As their mentor, Willis saw Morgan and Strank through the rigors of simulator training. That meant hour after hour of make-believe flying in a mocked-up B-47, instrumented so realistically that a crash landing is attended by shudders and the shrill complaints of crunched and wrenched metal.

FAMILY GROUP in Maj. Morgan's Altus, Okla., home is typical of SAC pilots. With him are Mrs. Morgan, Linda, six, and Mike, 10.

He met them on the flight line after they had been wrung out in the McConnell classrooms. He gave them their first ride in a jet bomber—a flight without apparent power conducted in a cathedral stillness broken only by the sound of air, like surf breaking.

He coached and coaxed Morgan through take-offs and landings until his student could taxi back to the flight line after four hours aloft without clammy palms and aching nerves.

Willis drummed away on the checks:
"Steering ratio selector."
"Taxi detent."
"IFF."
"Set."
"Slaved and directional gyro."

[Continued on page 246]

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I'd Like to see them make...

A POWER GRASS CLIPPER driven by a flexible shaft from a power mower. At a tree or wall, you'd just put the mower in neutral and turn on the clipper.—*T. Lane, Vinalhaven, Maine.*

AN EASY-TO-CLEAN PAINTBRUSH like a cook's pastry brush. The retractable collar would let paint remover reach deep down into the bristles.—*Mrs. A. Rosenfelder, Chicago.*

A THREE-LEGGED LADDER that could be set up without danger of wobbling where ground slopes away from a house, or under trees where ground is uneven.—*J. E. Blair, Portland, Ore.*

BUILT-IN VENETIAN BLINDS in Thermopane windows. Sealed away from dust, the blinds would stay clean, saving a housewife one more chore. —*D. J. Hendrick, Grand Marais, Mich.*

ASH TRAYS IN STEERING WHEELS of cars so drivers could flick off ashes without leaning forward. Use of horn ring leaves room at hub for receptacle.—*J. R. Baca, San Francisco.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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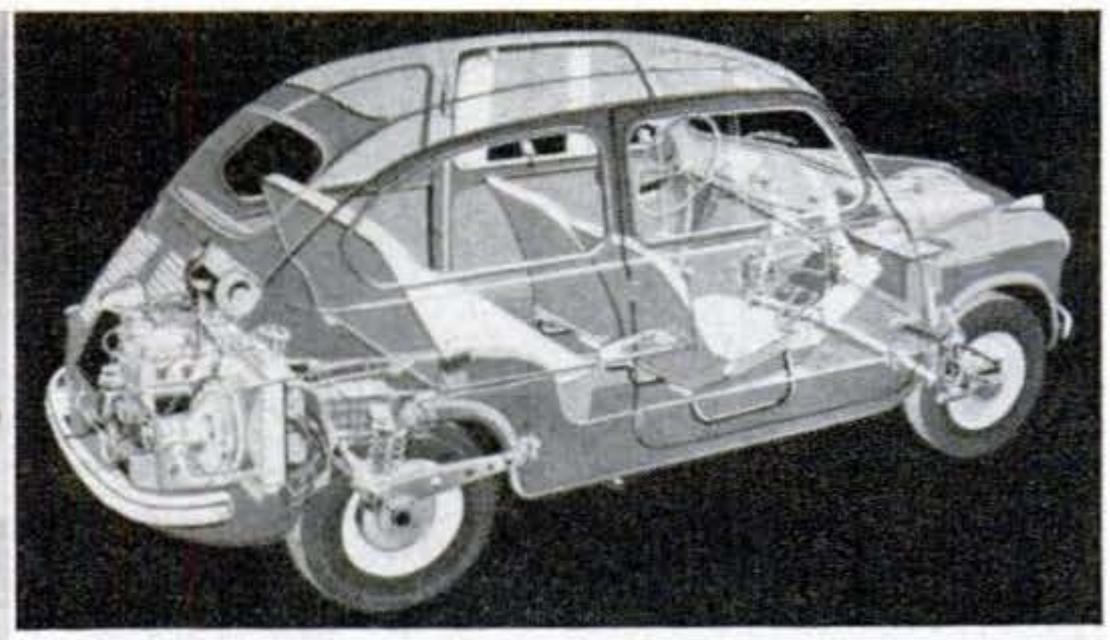
New Rabbit Has Built-in Black Eyes

THIS is El Bandido, a bunny of a brand-new strain. He got his name—Spanish for "the bandit"—because of his built-in mask, a ring of black fur around the eyes. The black markings on the white fur also look like a pair of shiners, so Leon E. Morton of El Centro, Calif., who bred him, calls the new breed of rabbits Black Eyes.

▶▶▶Ever hear of Cow Trees? They grow in Costa Rica and South America. The natives "milk" them by tapping them like rubber trees and drink the sap. But it won't put the cow out of business. After exposure to air, the milk turns chalky and bitter.



Baby Fiat Totes Bags Up Front

THIS cutaway shows how Italian engineers cram the works into the tiny new 600 Fiat, then fit in seats for four riders plus space for their bags. A four-cylinder engine with a top speed of 60 miles an hour and a low appetite—32 m.p.g.—rides at the rear. The gas tank is stowed under the little car's hood (left) with space left over for luggage, tools and a spare tire.

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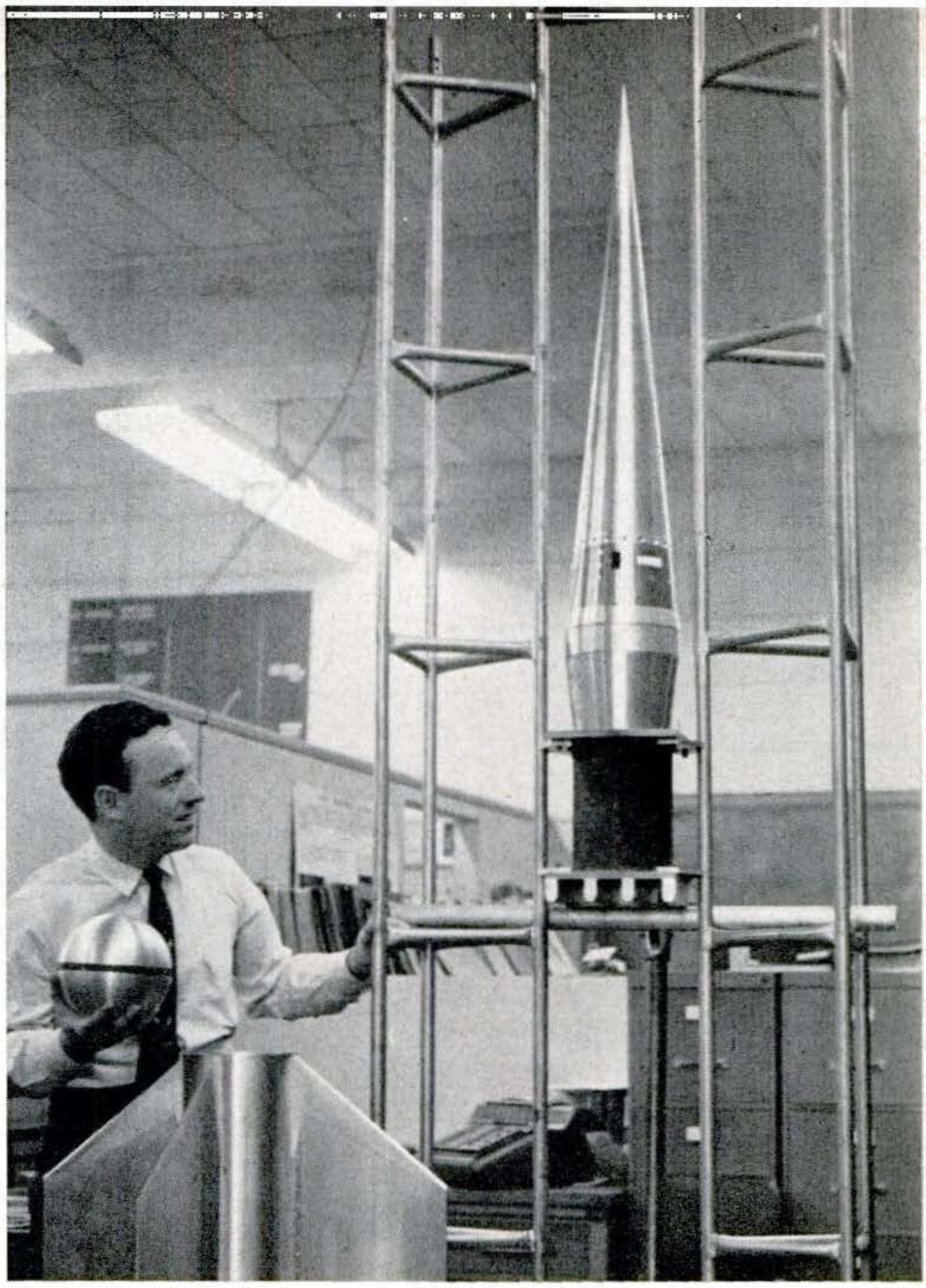
Cheaper Rocket to Gather Facts on Upper Air

SLIMMED-DOWN rockets built at the University of Michigan will help the Defense Department probe the upper atmosphere for a seventh of what the job costs with heavier, more elaborate models. When the needle-sharp nose on the test rack at right is fitted to its finned body, the rocket stands eight feet tall. It weighs only 220 pounds.

An aluminum sphere crammed with equipment rides inside. The rocket's main job is to carry this ball up about 400,000 feet and drop it. As it falls, it measures its own rate of descent and radios the data back to earth so density and temperature of the air can be calculated.



Push Buttons Focus Camera

FAST focusing is easy with this new 35-mm. camera. You just look through the coupled range finder and press buttons with your index fingers, working cams that slide the lens into focus. Graflex, Inc., makes the new f/3.5 Graphic 35.

They Shoot Bullets at the Rain

WHAT does rain do to materials used in supersonic aircraft? To find out, Convair mounts specimens in cartridges and fires them through simulated rain at up to 1,900 m.p.h. Test specimens float down on tiny chutes, many badly eroded, as shown above.

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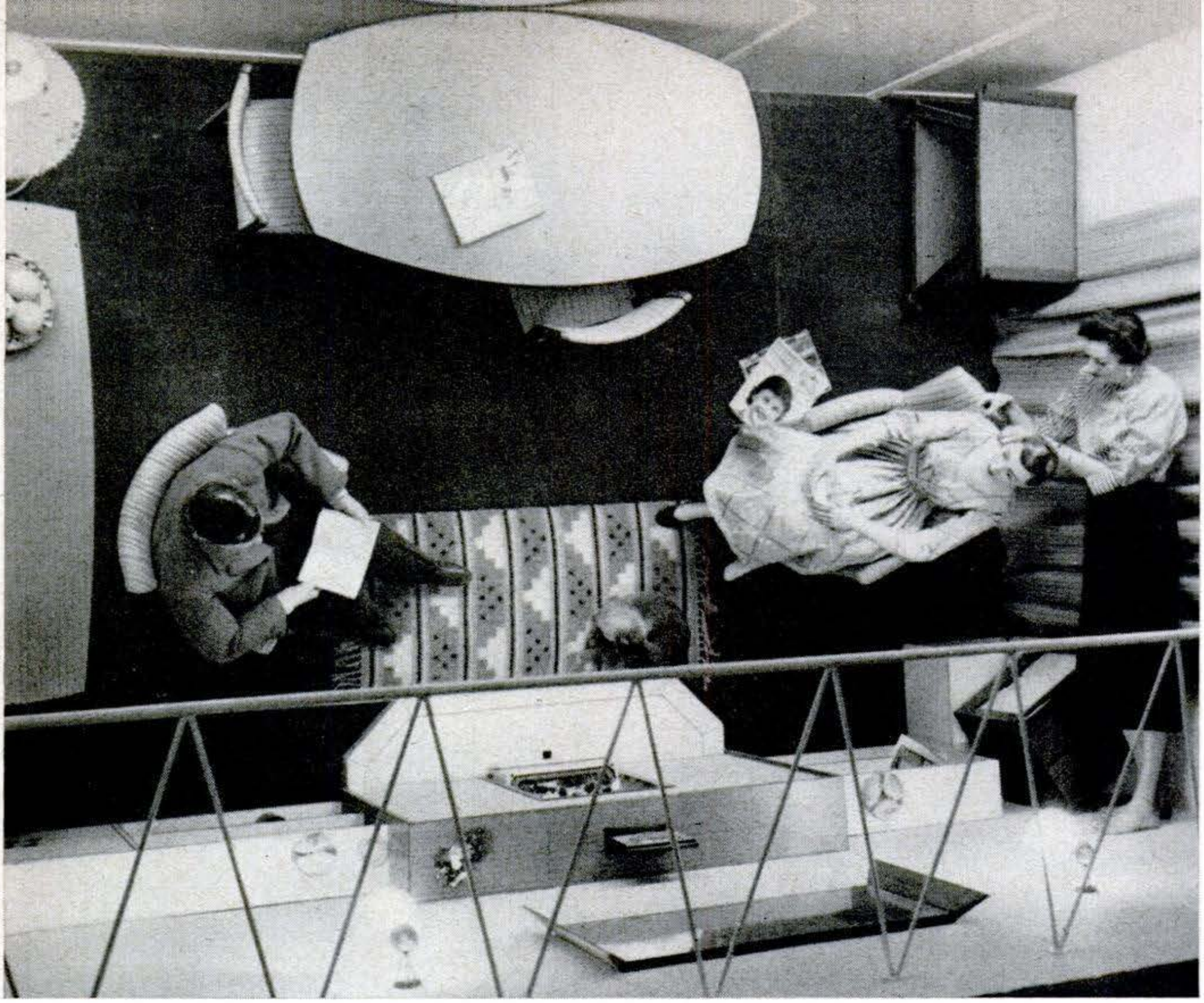
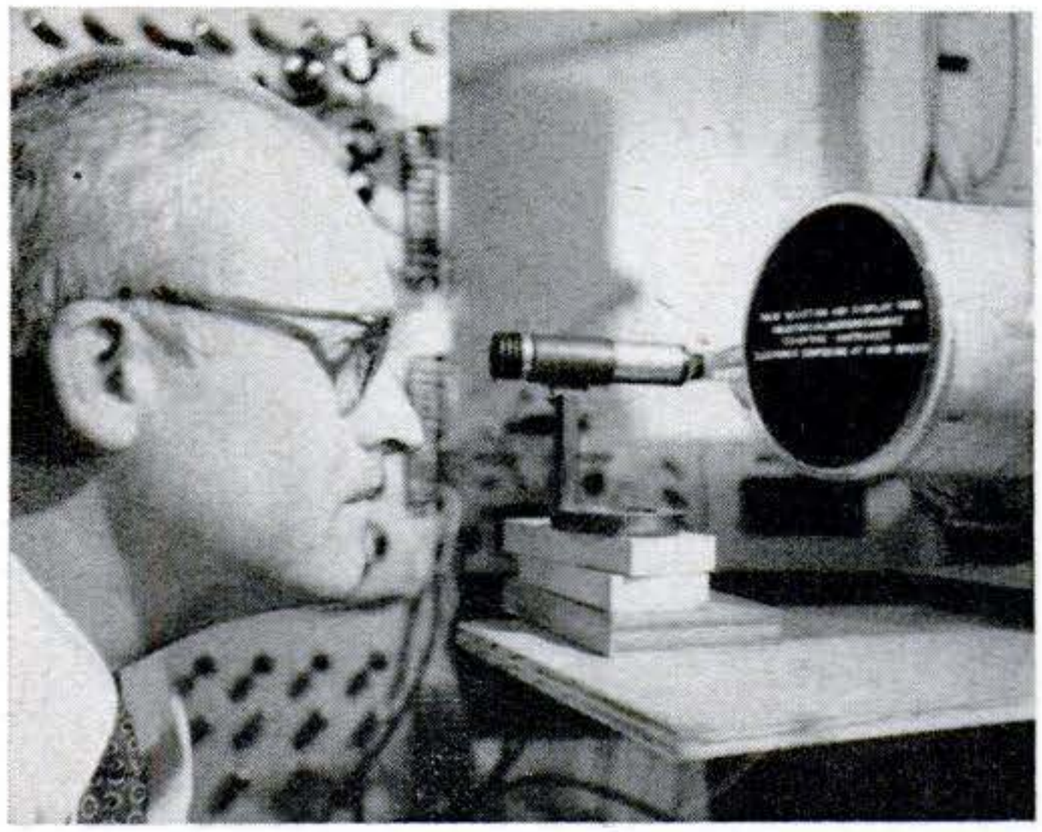


Living Room on Its Side Shows Off New Furniture Better

ONLY a fly could walk across this room and only dummies, screwed down, could sit in the chairs. The furniture is attached to the walls and ceiling or laid, back down, on the floor (where a real woman is standing at right). The odd arrangement was used at a London exhibit to show off the laminated plastic tops on the furniture.

Kids Get Big-League Safety Cap

A BASEBALL cap just like the ones worn by major-league ballplayers may mean fewer cracked heads in the Little League crowd. It's a tough plastic shell lined with a rubber cushion. American Baseball Cap, Inc., Park Bldg., Pittsburgh, makes the cap.



Alphabet Tube to Speed Print

A NEW electron-image tube (above) translates coded signals from tape, keyboard or radio into actual print that can be photographed. RCA expects the tube to open the way to new high-speed printing devices, such as an electronic typesetter.

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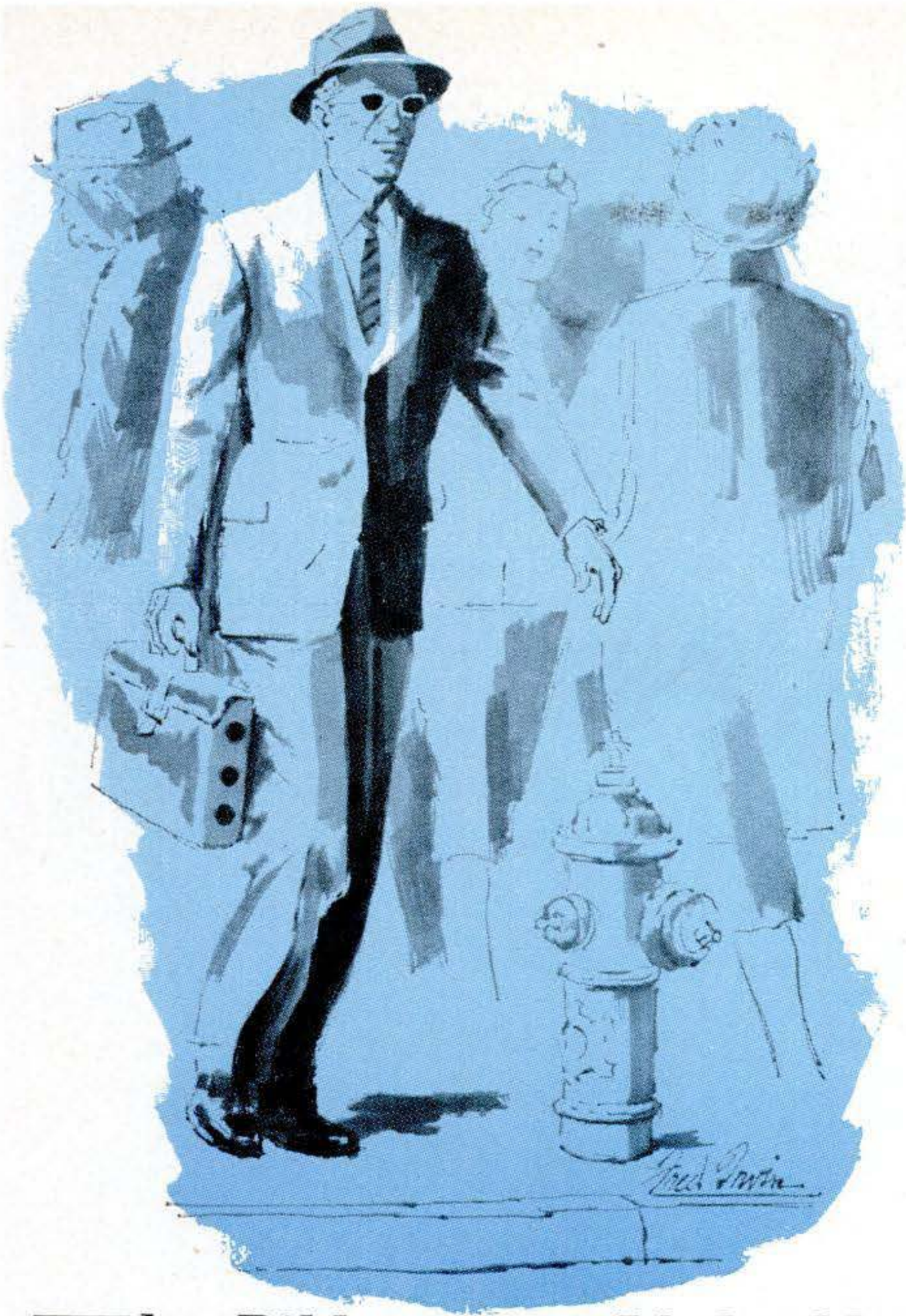

Electronic Eyes for the Blind

By Martin Mann

The Bible says: "If the blind lead the blind, both shall fall into the ditch."*

Now two blind men are trying it anyway with the hope of keeping their fellows *out* of the ditch. They are making an electronic eye for the sightless. Like a tiny radar, it will detect and warn of obstacles ahead—buildings, people, lamp-posts. It will tell where the obstacles are, and will give a special signal for curbs and steps.

This remarkable achievement, approaching completion, is the work of Thomas A. Benham and Clifford M. Witcher. Both men are just 40 and have been blind since they were babies. Both have become high-ranking scientists: Benham is Assistant Professor of Physics at Haverford College; Dr. Witcher is on the staff of the Research Laboratory of Electronics at MIT.

Benham and Witcher became involved with the electronic eye—"guidance device," they call it—shortly after the war. Signal Corps engineers at Fort Monmouth, N.J., had developed a black box that

**Matthew, XV, 14*

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could detect obstacles pretty well. It was the first such device that was partially successful.

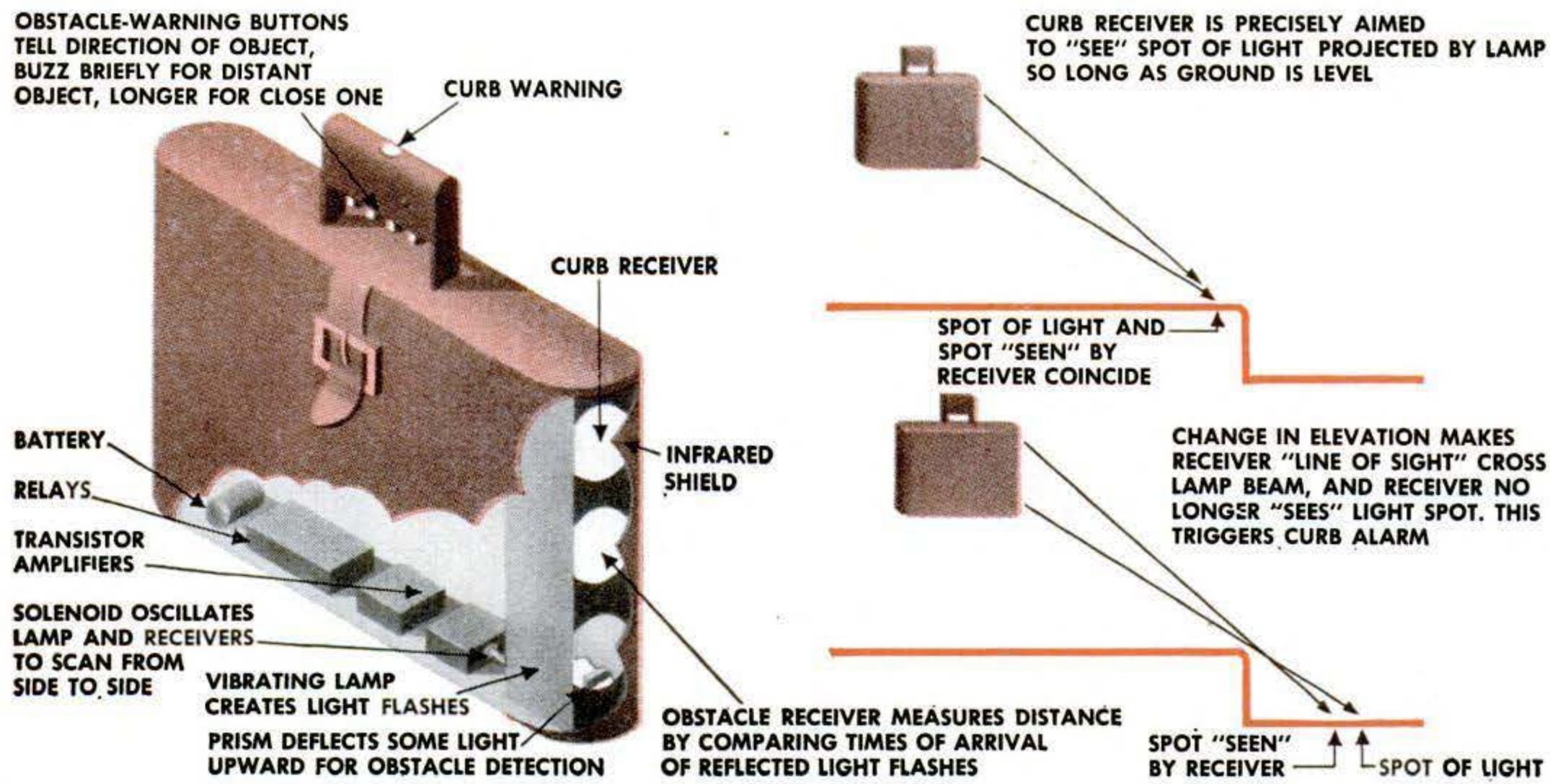
The Signal Corps unit had a lamp shining through a spinning perforated disk. These flashes of light were reflected back by an obstacle to a second perforated wheel covering a photoelectric cell. The angle of the reflected light varied with the distance of the obstacle and thus determined where on the wheel the light fell. And that acted on a photocell to generate a current whose frequency of pulse varied with the distance to the obstacle.

The current operated a vibrator in the handle. The blind person learned that a rapid buzz against his fingers meant a close obstacle, a slower one an obstacle farther off. A still slower buzz meant that he was "seeing" the ground eight or 10 feet away.

DR. CLIFFORD M. WITCHER demonstrates the "front end"—light source and receiving cells—of his electronic eye for the blind in his MIT laboratory. The scientist, himself blind, expects to conceal the finished device inside an unobtrusive brief case as shown in the sketch below.

Benham's post at Haverford College, a small but highly regarded liberal-arts school, is not far from the Army's big Valley Forge Hospital. "Sgt. Hoover—he's now Dr. Richard E. Hoover, an eye surgeon at Johns Hopkins—was rehabilitating blind GIs there during the war," Benham recalls. "He got me to come out as a sort of walking case history, to show them what could be done. So when the first Signal Corps device was sent to Valley Forge, I tried it out."

Later RCA manufactured 25 of the machines, and the Veterans Administration gave Benham the job of running a test program. This took a year and involved 67 blind people in the Philadelphia area. Most of them liked it. One man



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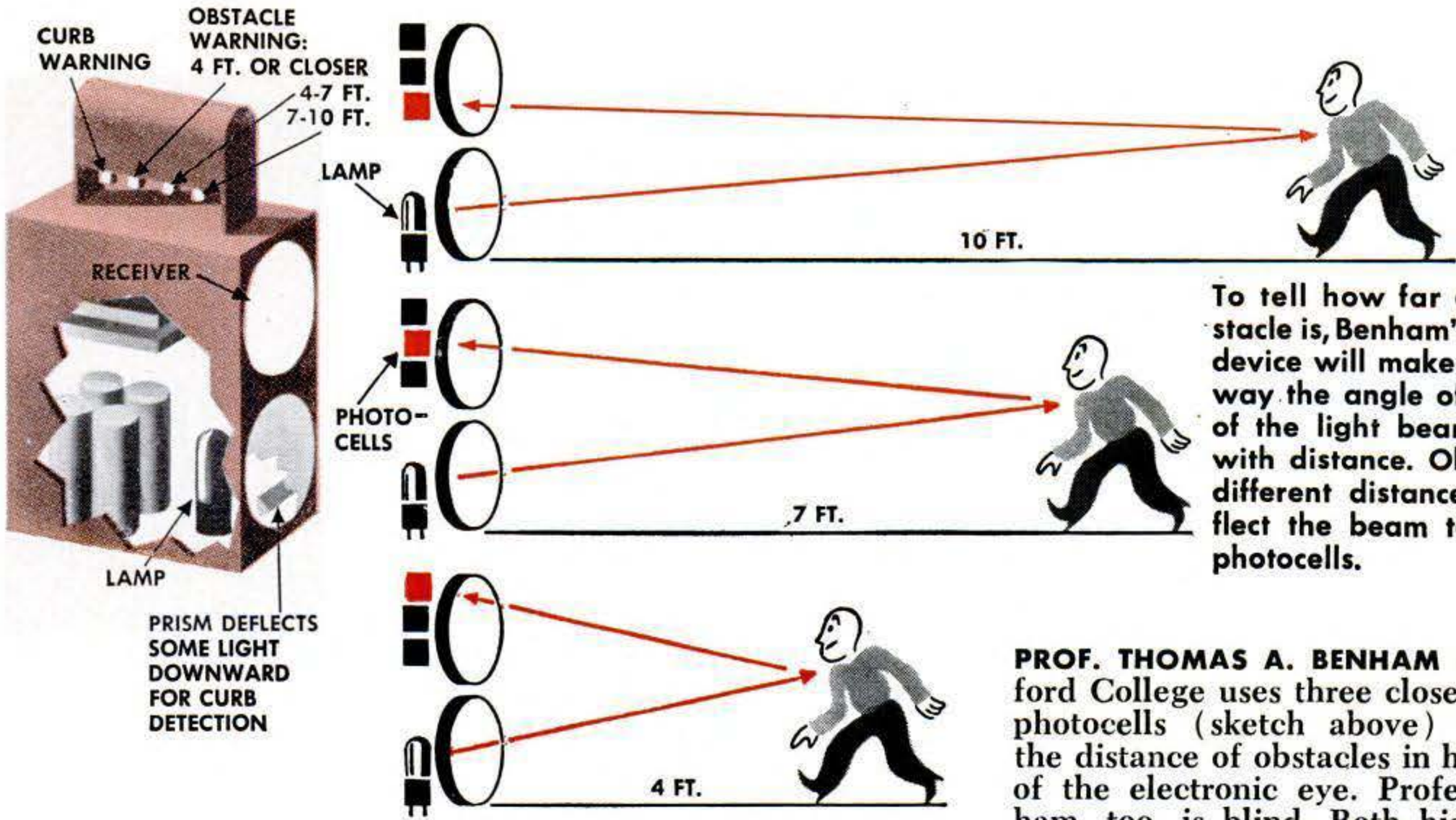

To tell how far off an obstacle is, Benham's guidance device will make use of the way the angle of reflection of the light beam changes with distance. Obstacles at different distances will reflect the beam to different photocells.

PROF. THOMAS A. BENHAM of Haverford College uses three closely spaced photocells (sketch above) to gauge the distance of obstacles in his version of the electronic eye. Professor Benham, too, is blind. Both his and Dr. Witcher's projects are supported by Government grants.

used his every day for three years. But others found serious faults.

The device was heavy. Its continuous buzzing was tiring. It failed often, as might be expected of any first model. And it was very weak on curbs and steps, which caused only delicate changes in the buzz rate.

At this point Benham and Witcher got their heads together. Physicists incline to clannishness and it was natural that the two blind scientists should be acquainted. Witcher himself had already been working on theoretical studies of guidance devices at the Technical Research Council, a group of blind professional people in New York City.

They planned to collaborate on a workable eye, splitting the project in two. Witcher was to concentrate on a curb locator while Benham improved the obstacle detector. The two units would then be combined into one instrument that, they hoped, would be light, sturdy, simple to use and easy on batteries. It hasn't worked out quite that way.

The collaborators are not averse to friendly, but spirited, comments on each other's approach. Benham says, "Cliff and I don't see eye to eye on some details."

As a result of this conflict of view, each is now on the road to a complete device that will be quite different from the other's.

Benham, a slight, introspective man who looks at home in his old-fashioned office with its roll-top desk, has only

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undergraduate laboratory facilities at Haverford. The engineering work on his eye is done under his supervision by Biophysical Instruments, Inc., a small Philadelphia firm (five people) that specializes in medical and electronic equipment.

They have evolved a compact, lightweight obstacle detector that needs very little electricity. "It's as good on obstacles as the Signal Corps device—keep your fingers crossed—for one-twelfth the power," says Benham. "And it's easier to interpret."

There are no moving parts and no vacuum tubes—transistors are used throughout. A specially designed discharge lamp filled with xenon gas flashes on 20 times a second. The flashes reflect from obstacles back to one of three light-sensitive transistors. These are a new type, made by Philco, that respond very rapidly to light and thus permit use of brief flashes.

PARENT of improved "seeing eyes" is this Signal Corps device. All use invisible infrared light beams—radar is too complex and sound beams would interfere with a blind man's ability to hear many dangers, such as cars.

By using three light receivers, Benham is able to provide a blind man with range information: is there an obstacle closer than four feet, between four and seven feet, between seven and 10 feet? Each receiver has its own transistor amplifier and feeds a warning button in the handle. The buttons are placed to strike the middle segments of the fingers. They vibrate only when the receiver signals that an obstacle is ahead. A buzz against the forefinger, for example, means an obstacle between seven and 10 feet away. A fourth button, for the little finger, is reserved for the curb locator, which is only now being designed.

Benham does not intend to use the thumb. "You can tie down the four fingers," he says, "but not the thumb. You have to be able to move the thumb around to get a comfortable grip."

This scheme gives range but not direction—is the obstacle to the right, left or dead ahead? "Witcher goes for automatic scanning," Benham comments. "Nonsense, I say. Sure you can scan. But if you're going to tell a man all kinds of extra information, you have to put warning probes all over his body. You have to hit him on the left knee to tell him there's an obstacle 10 degrees to the left at four feet. It's easy enough to scan manually by letting the wrist oscillate the device. That's the same kind of thing blind people already do with a cane."

A major upkeep cost with any guidance device will be batteries, and Benham has used every trick he can think of to keep this expense low. His light and amplifiers are off nearly all the time. During their very brief operating pulses, they burn little juice—an average of 85 thousandths of a watt. (The Signal Corps device used 1.2 watts and its batteries needed recharging after 15 hours.) Benham plans to use standard hearing-aid cells, tiny disks about the size of a nickel. To get the voltage required, he will need a number of them stacked up.

Witcher takes a different tack. "Benham always worries about battery drain, but then he puts in four separate amplifiers. Here's what I use," Witcher says, holding up a plastic-cased silver storage battery about the size of a pack of cigarettes, a type widely employed in airplane instruments. "It lasts 20 hours before you have to recharge it. And if it runs down when you're out, you can always get back home with a 10-cent flashlight cell—it's the same voltage."

Witcher is a husky, hearty man who drawls with a ready smile as his fingers reach confidently over his desk for

[Continued on page 248]

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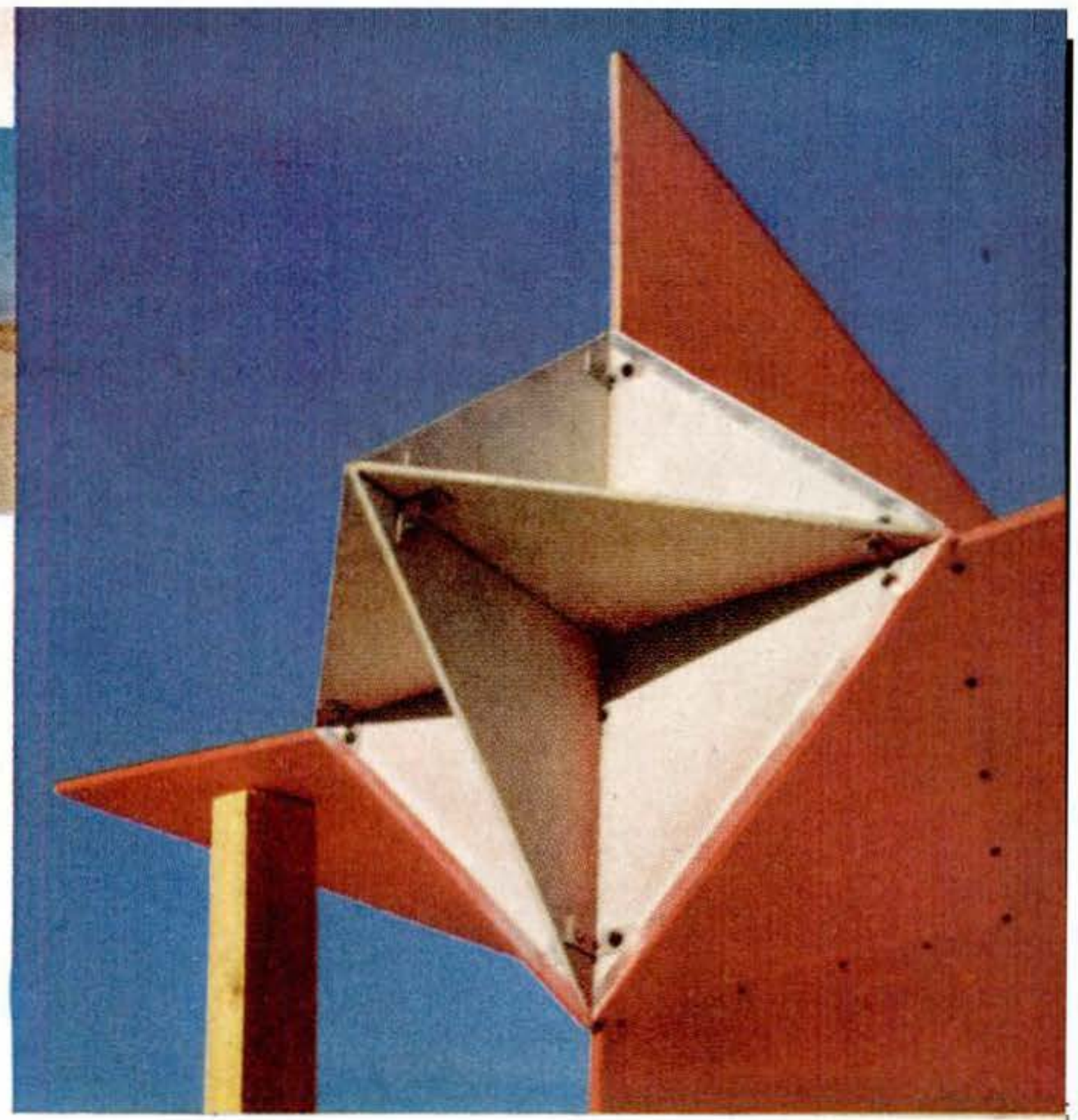
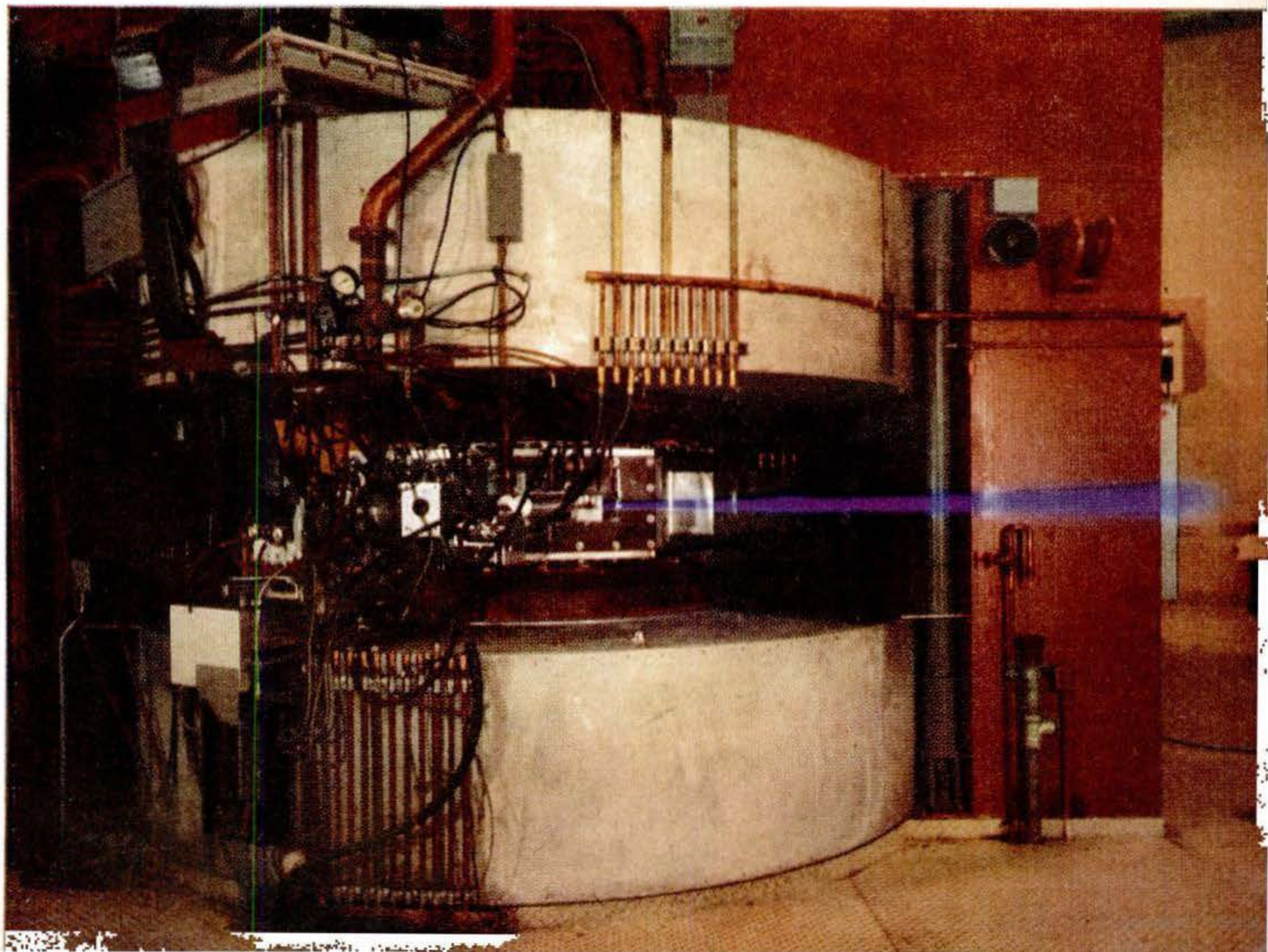


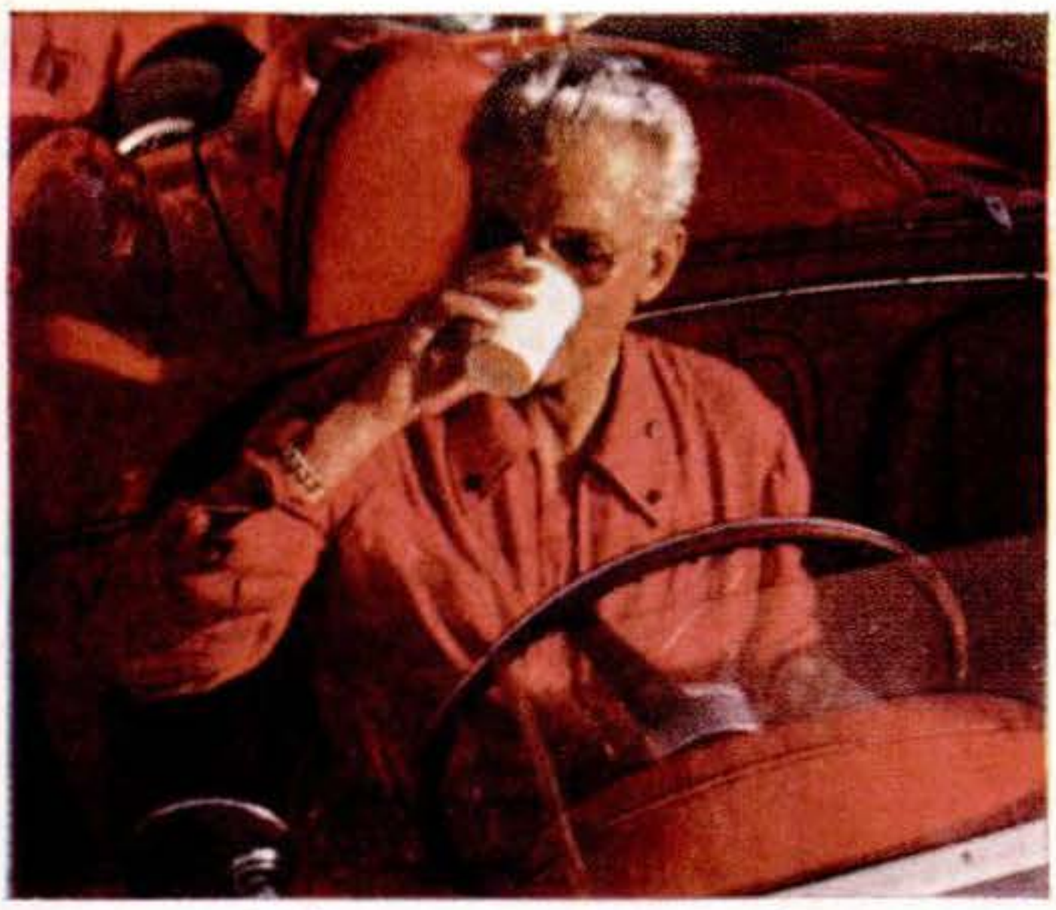
Flying darts of plywood, towed far behind fighter planes, are targets for guided missiles at the Navy's Ordnance Test Station, Inyokern, Calif. They are designed for visibility to radar "eyes" as well as human ones. Metallic paint coats tail surfaces whose "corner" pattern, right, bounces back radar waves in the same direction from which they came.

Beautiful and deadly, a luminous blue plume 11 feet long highlights this scene in a chamber of modern alchemy. The eerie death ray is an intense beam of deuterons and protons, emerging from the 60-inch cyclotron of Argonne National Laboratory at Chicago. On striking the air, the atomic particles make it glow, a phenomenon akin to the Northern Lights. For this color photo, Joseph Kucera, Argonne photographer, used an exposure of eight minutes in the dark to register the ray, and filled in the background with flash bulbs.



An instant after the start, each driver is fighting fiercely for position into the first turn.

He's America's No.1



BEAT, Kimberly sits in car for a few minutes after the race to unwind. Driving a 350-hp. car at its limit for hours is distinctly tiring.

Handsome, rich Jim Kimberly prepares for a race just like a general planning for D day.

By Frank Rowsome Jr.

PHOTOS BY HUBERT LUCKETT

JAMES H. KIMBERLY, a prosperous, middle-aged businessman, has been driving sports cars in competition for barely five years. The results, as with most things that Kimberly touches, have been spectacular. Last year he started his Ferrari in 20 of the toughest sports-car races in the U. S. He took first place in 17 of them, second in one, and was sure winner in another when,

Sequence camera shows Kimberly cornering at high speed. Precise tracking, braking and

Kimberly is at wheel of the big red 4.9 Ferrari that is coming up outside on the left.

Sports-Car Driver

on the last lap, his engine blew up.

His driving has won so many silver cups as to constitute a storage problem. It has also earned the wary respect of competitors, who have observed that Kimberly is more than just a rich dilettante dallying with fast cars. Instead, he has become what the fraternity describes as a "real fine chauffeur."

Scuderia Kimberly. The racing establishment he runs is elegant enough to dazzle onlookers. Kimberly descends on a race like Greentree Stable or Calumet Farm arriving for the Derby. There's a fancy special truck fitted with everything including the kitchen sink. There's a special trailer for each sports car that may be needed, a sedan and station wagon as well, several experienced mechanics, and stocks of spare parts. Everything is colored a scalding fire-engine red, including the mechanics' coveralls.

"Kimberly red" is also the color of the jumper, shoes and crash helmet that "Gentleman Jim" himself wears. "Scuderia Kimberly"—the word is Italian for stable—is breathtakingly elegant in all its aspects.

Sedate in a sedan. On form, you might not expect it. Kimberly, who will be 48 in August, looks in city clothes like Hollywood's image of a successful businessman. Grandson of a founder of Kimberly-Clark, the big paper-making

rapid-fire shifting are essential. Such a turn is a "separator"—it tells the men from the boys.

BEFORE A RACE, it's virtually impossible for Marsh Lewis to keep his hands off the engine.

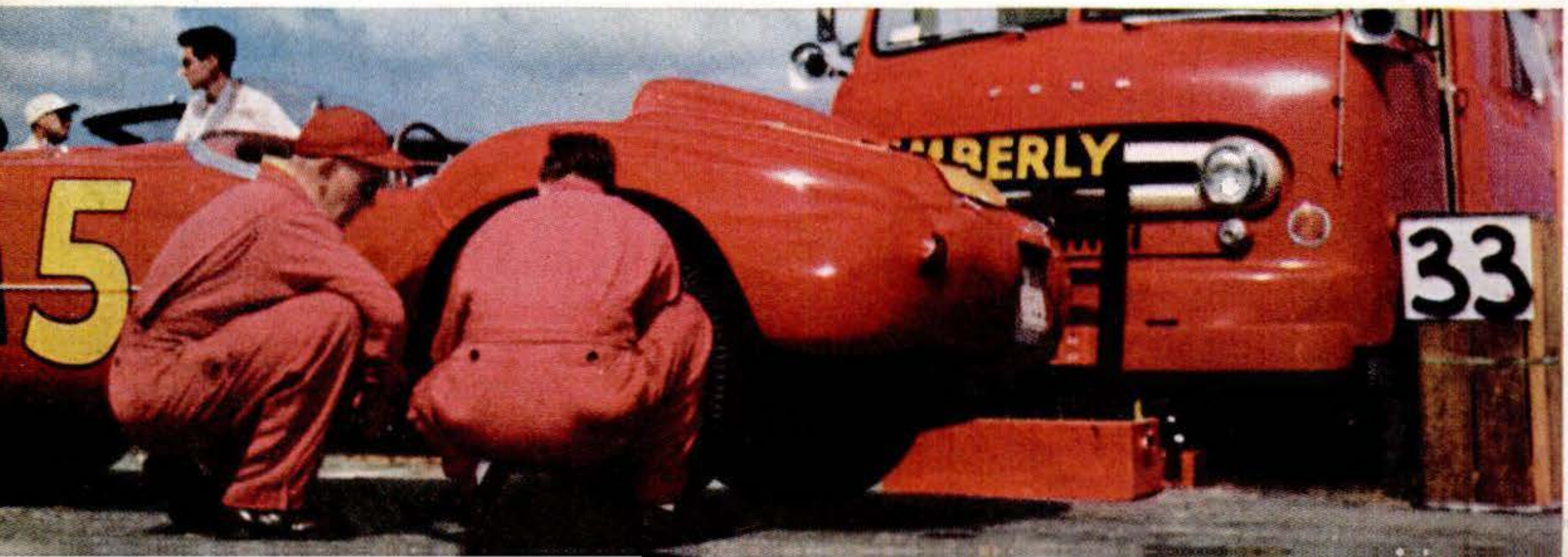
CODED PIT SIGN—coded to keep strategy a secret—is held by Marsh as Kimberly flashes by.

HAMBURGERS from the truck's kitchen taste fine. In race, girls keep up a detailed time chart.

concern, he is in charge of production for International Cellucotton Products (Kleenex, Kotex and Delsey). He dresses conservatively, is graying and nearsighted, and has three teen-age daughters. On the highway he drives a Ford or a Cadillac, rather sedately.

Your first impression is that he would be better at contract bridge than at skidding around a hay-baled turn. But a few clues point the other way. One is the lavishly equipped garage behind the family home in Neenah, Wis., which obviously reflects a man with a strong mechanical bent. Another is the fact that, as a kid, he raced iceboats on Lake Winnebago with a ferocity that is still

Each of the tires gets the exact pressure found best in practice for that particular course.



remembered. Before the war (which he spent in the Coast Guard) he garnered a caseful of cups with *Phantom III*, a famous racing sailboat.

But since 1949, when he first drove a Jaguar XK120, his love has been sports cars. From the Jag he progressed to a Healey Silverstone and to an array of Ferraris ranging in size from two liters to, currently, 4.9 liters. The 4.9 Ferrari is one of the world's ablest, costliest* and meanest cars. It has won at Mexico and Le Mans, and is widely distrusted by drivers as a vicious vehicle. Packing 350 horsepower in a 2,260-pound gross weight, it can, during incautious acceleration on a bone-dry road, slither like a bike on ice. Shrilling up toward 7,000 revs, its 12-cylinder engine squalls like a platoon of hysterical women.

Winter quarters. Scuderia Kimberly logged more than 20,000 miles in 1954, orbiting from winter quarters in Wisconsin to races in California, Florida, New York, Oklahoma and points between. Typically, the truck, station wagon, and trailer-borne racing cars set out some days ahead, piloted by Marshall Lewis, Kimberly's chief mechanic, and by another man or two. Kimberly flies out to join the rig the day before a race.

One cold evening last January Kimberly and Marsh Lewis gathered in the big garage at Neenah to check on the Scuderia's readiness for the '55 season. Kimberly walked restlessly about with check list in hand, stopping occasionally to scratch Mike, the retriever that sleeps by the furnace. Marsh, a genial, weathered man with a long background in racing, walked about with him. In one corner, still in its crate, was a spare $9,000 Ferrari engine.

For the first swing, to Florida, they decided to take the 4.5 and 4.9 Ferraris, and to leave the Osca and the spare engine. They'd take a spare transmission, several sets of rear-axle gears and a big stock of extra wheels and tires.

The quick one. It was clear that both

**Around $19,000 at the factory. But first you'd have to prove you could handle it. Letting inexperienced drivers loose in such cars is roughly comparable to stocking a kindergarten with automatic shotguns for recess play.*

EIGHT STOP WATCHES in a hinged case allow mechanic George Colby to record practice lap times on Kimberly and three other drivers. Seats in front of truck are swiveling airliner type.

PRACTICE OVER, Marsh eases the 4.9 into its trailer and tows it off for last-minute touch-up adjustments. A canvas-topped trailer was wrecked earlier, flinging 4.5 car through top.

NIGHT-BEFORE WORK also involves checking wear incurred in practice. Here Marsh inspects the drums. Running gear is magnafluxed frequently; engine is torn down after every race.

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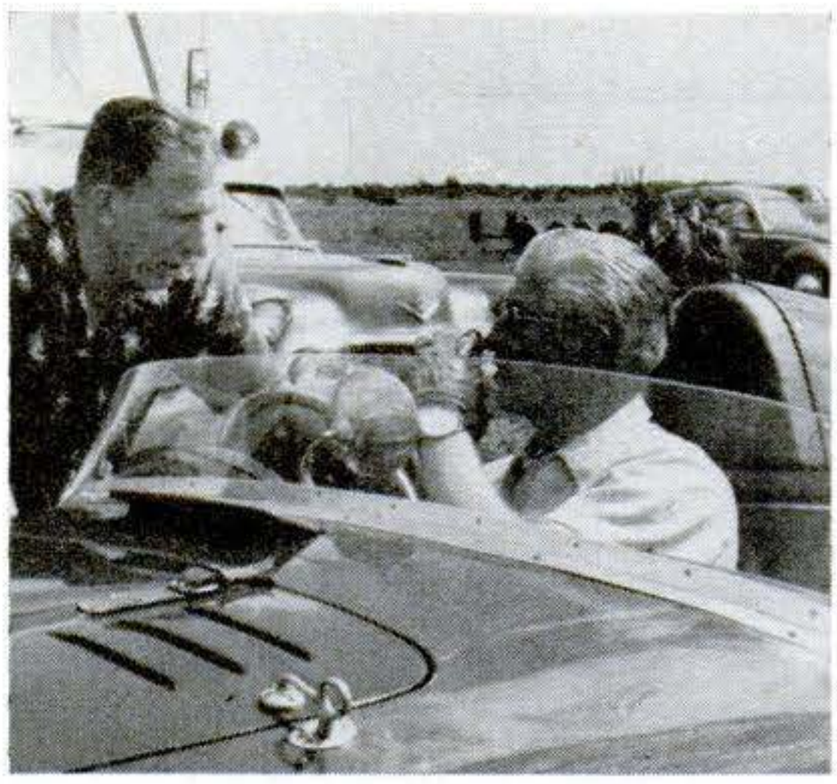
men favored the 4.5 Ferrari over the newer, untried 4.9. For one thing, the 4.5 was the car that had "gone so quick" in 1954. It had a graceful Pinin Farina body built to Kimberly's own drawings. During the winter Marsh had lovingly reworked the engine. It had a special new $3,000 crankshaft and new machined-all-over rods that they'd had built to their designs.

On back roads Marsh had given it a whirl that suggested it was hotter than ever. Once he had glowered protectively when Kimberly had brought some dinner guests out to the garage, fired it up so they could hear the ugly scream, and then cut it before it became really warm.

The Scuderia seemed ready for the wars. Klaus and Werner, two other mechanics around the place, had tuned the Cadillac engine in the truck and checked over the trailers. Kimberly walked slowly through the big truck. How was the gasoline-powered generator? The air compressor? How recently had the CO_2 extinguishers been weighed? Primus stove, iceboxes, thermos jugs? The hydraulic jacks and the racing jacks? Plenty of plugs and oil? The steel ladder and furnishings for the "bridge" atop the truck? Day and night pit signs? The electronic megaphone?



MARSH AND KIMBERLY confer repeatedly during practice. Partly they talk about how car handles, partly about strategy to be used in coming race.

After the last list had been checked off, Marsh began gently to kid Kimberly about overrevving his engine in the stress of a race. It was evidently a worn and affectionate joke.

Practice. Several weeks later, the day before an airport race in Fort Pierce, Fla., Scuderia Kimberly trundled up to the edge of a runway. Marsh and sidekick mechanic George Colby set up ramp rails at the back of the trailer, eased the big red 4.9 out, and warmed up its V-12. At a 1,000-r.p.m. idle, it thrumbled evilly, like a tank engine.

For both drivers and mechanics, day-before practice sessions are vitally important. Drivers memorize the course, experiment with turns, study surfaces and bumps. Each man tentatively picks his "cutoff" points—landmarks before each turn when he must get off the gas and begin the brake-downshift-brake-downshift sequence.

After an easy lap or two he "gets on it" and his crew clocks lap times. Other drivers are practicing, of course, and it's natural to clock the best of them, too.

Worry session. For mechanics, practice sessions are also busy. Are the magnetos timed right, to the last degree? Is there, heaven forbid, any sign of clutch slippage high up on the payoff slope of the power curve near 6,000 revs? Are the shocks set right for the surface? What tire pressures does this course want? Which carburetor jets for tomorrow's weather? Is the axle ratio the shrewdest compromise? Do the plugs show any sign of oiling up? (A racing mechanic pores over spark plugs like a Roman soothsayer pondering bird entrails.)

Kimberly took a half-dozen fast laps and then came in to confer soberly with Marsh, who made a slight change in shock-absorber setting and tire pressure. Then more laps, more changes. Both men were serious, even a little somber. Partly this was because this race didn't look like a scalp. Kimberly was going briskly, but so were four or five other cars. The 4.9 seemed too big for the three-mile course. The longest straight was 5,000 feet. There were nine turns, six of them 90 degrees or worse. "Just the ticket for the 4.5," Kimberly said.

Crumpled sweetheart. The prime cause for the somberness was an acci-

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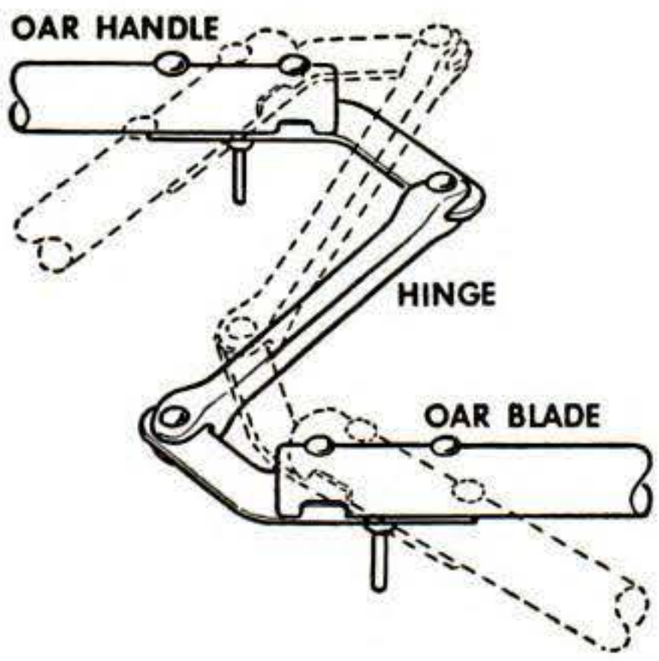
Bow-facing oars let rower watch for hazards. Pointed at both ends, boat resembles canoe.



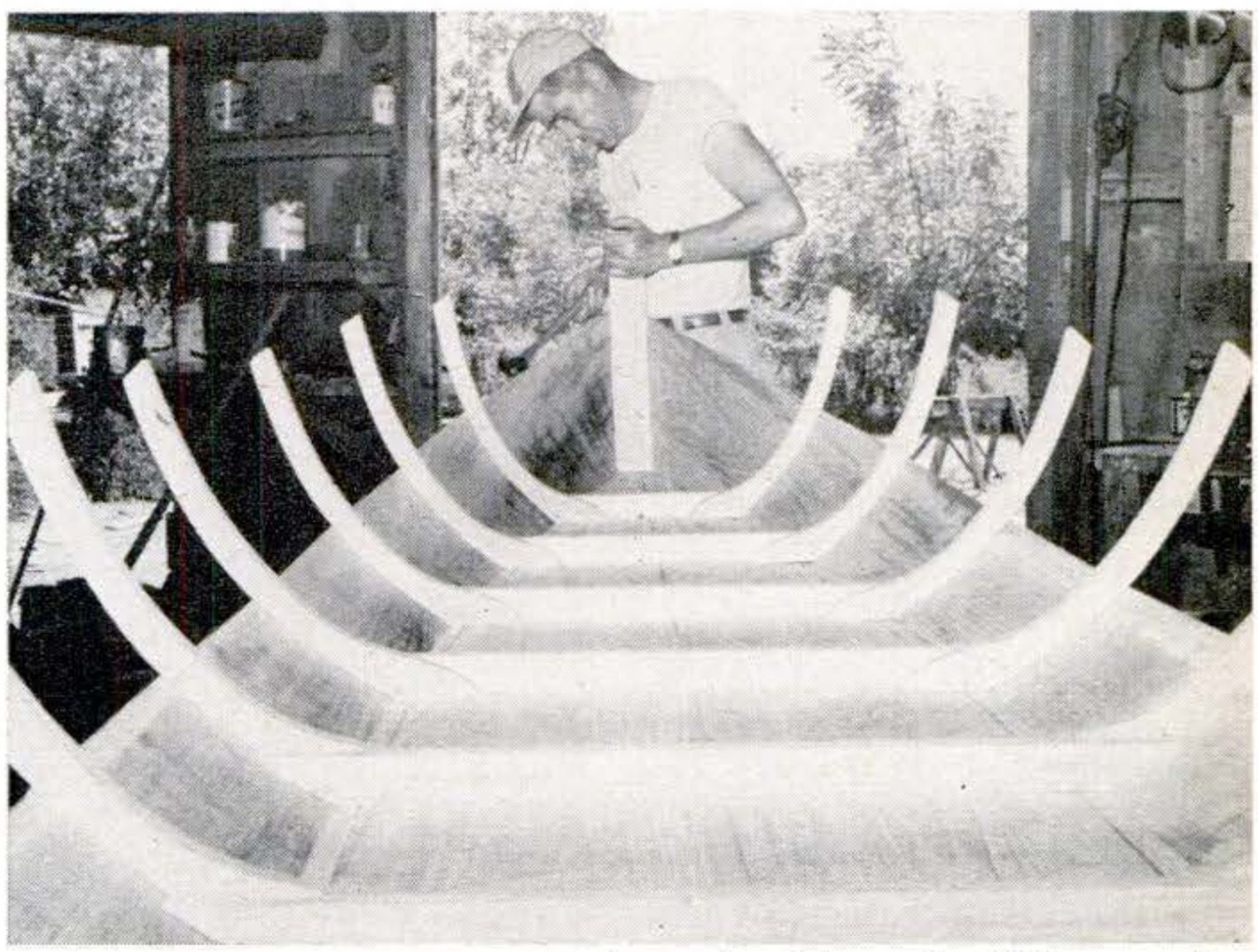
TWO-PIECE OAR has reversing linkage which causes blade to move backward as you pull handle toward you.

This Boat Rows in Reverse

On Reelfoot Lake, in Tennessee, a rower in an ordinary boat needs a swivel neck to keep from stoving in the bottom. Cypress stumps poke above water and lurk under its 23,000-acre surface. So, to navigate safely, natives mostly use ingenious Reelfoot craft built by Bill Calhoun in his lakeside shop near Tiptonville.

These boats carry two-piece "double-jointed" oars so a rower can face the bow to avoid stumps ahead. Of shallow draft with tin-plated hulls, they climb over underwater hazards undamaged. Both ends are pointed, and the bottom slopes up toward bow and stern. The 150-pound boat handles like the canoe it resembles, but is stronger and safer. Many of the 3,000 on the lake have inboard motors.

TWO-MINUTE SOAKING in tank of boiling water makes cypress siding easy to form to hull without splitting.



SIDING IS NAILED OVER RIBS of tough white oak. Calhoun relies on five-penny box nails, uses no glue. Second board added at each side will bring depth of boat to 15 inches. Bottom width varies to suit customer's taste. This is a 24-inch bottom.

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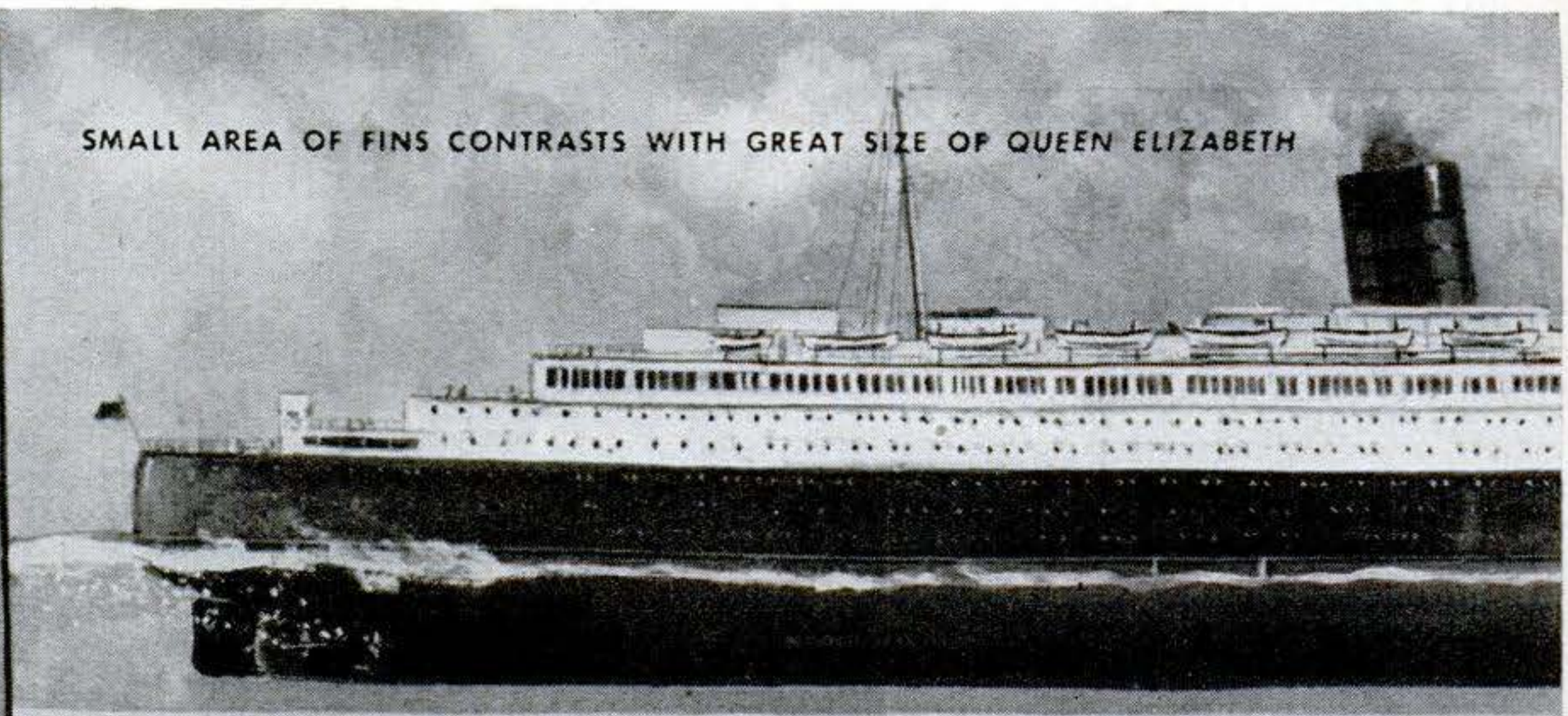
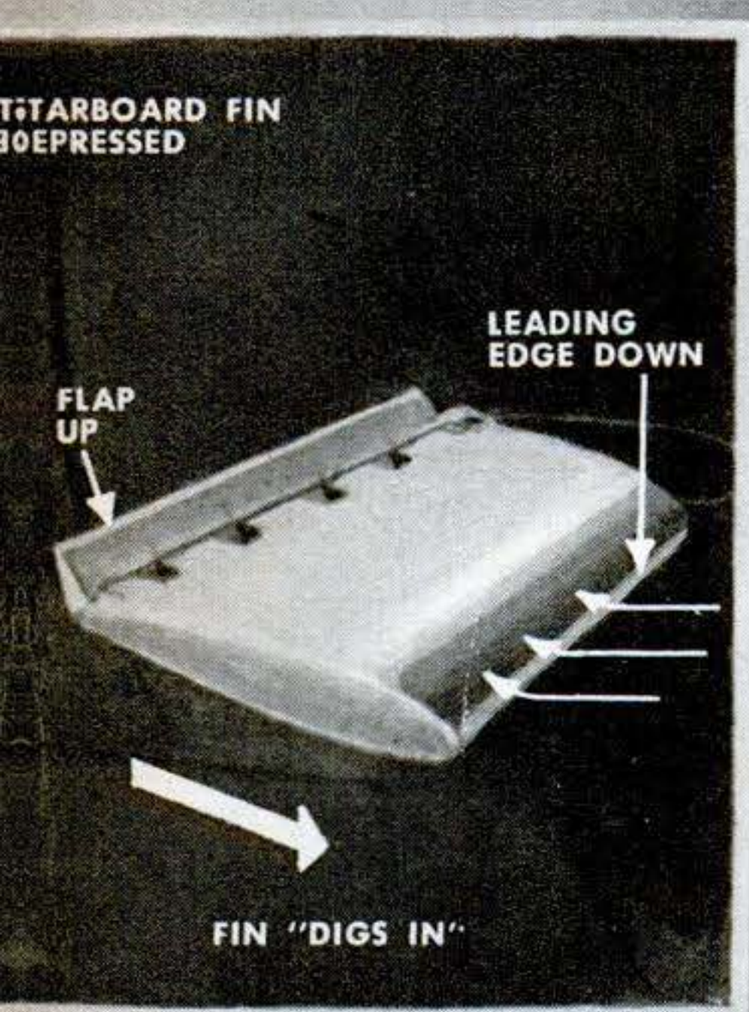
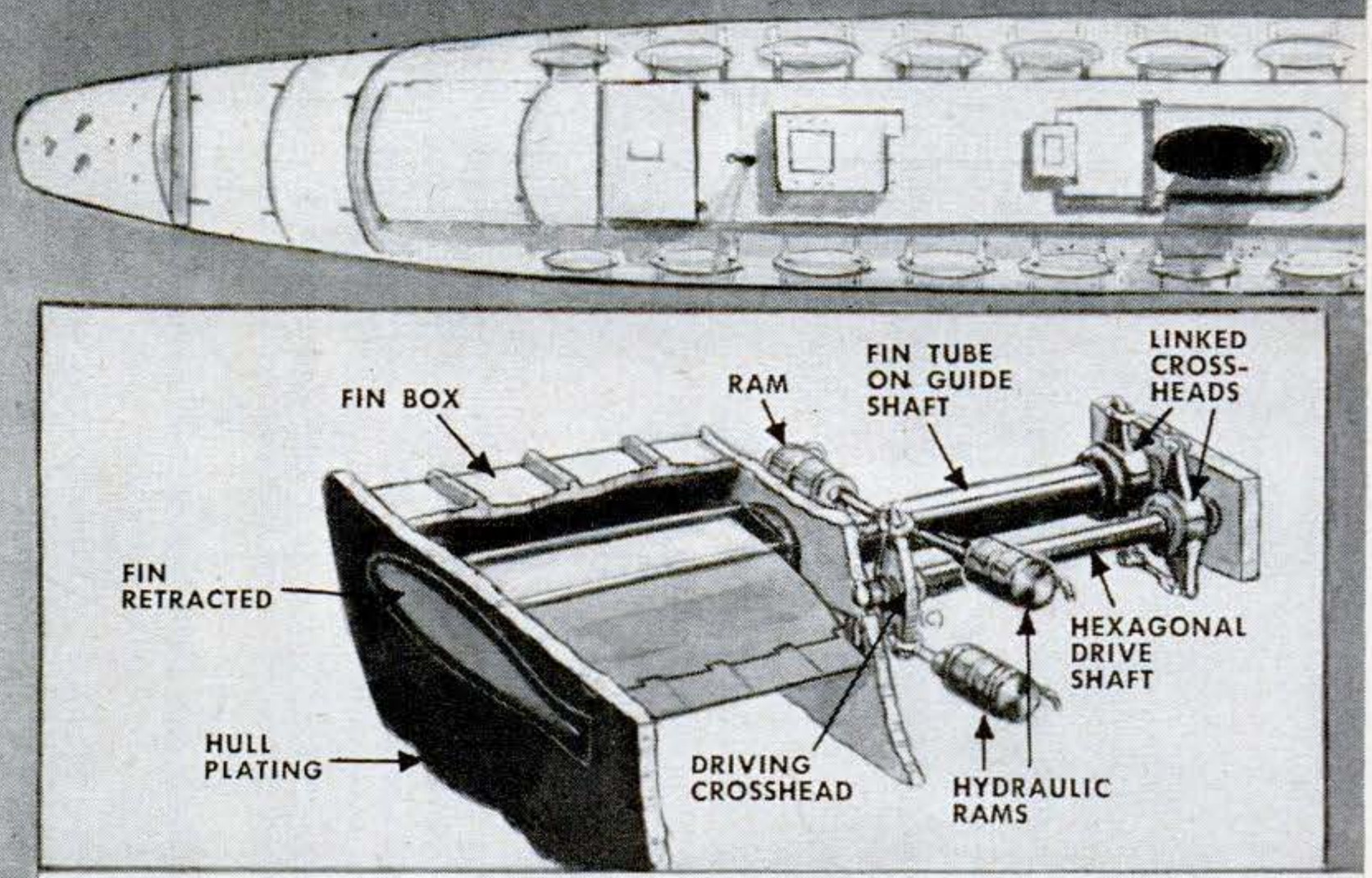
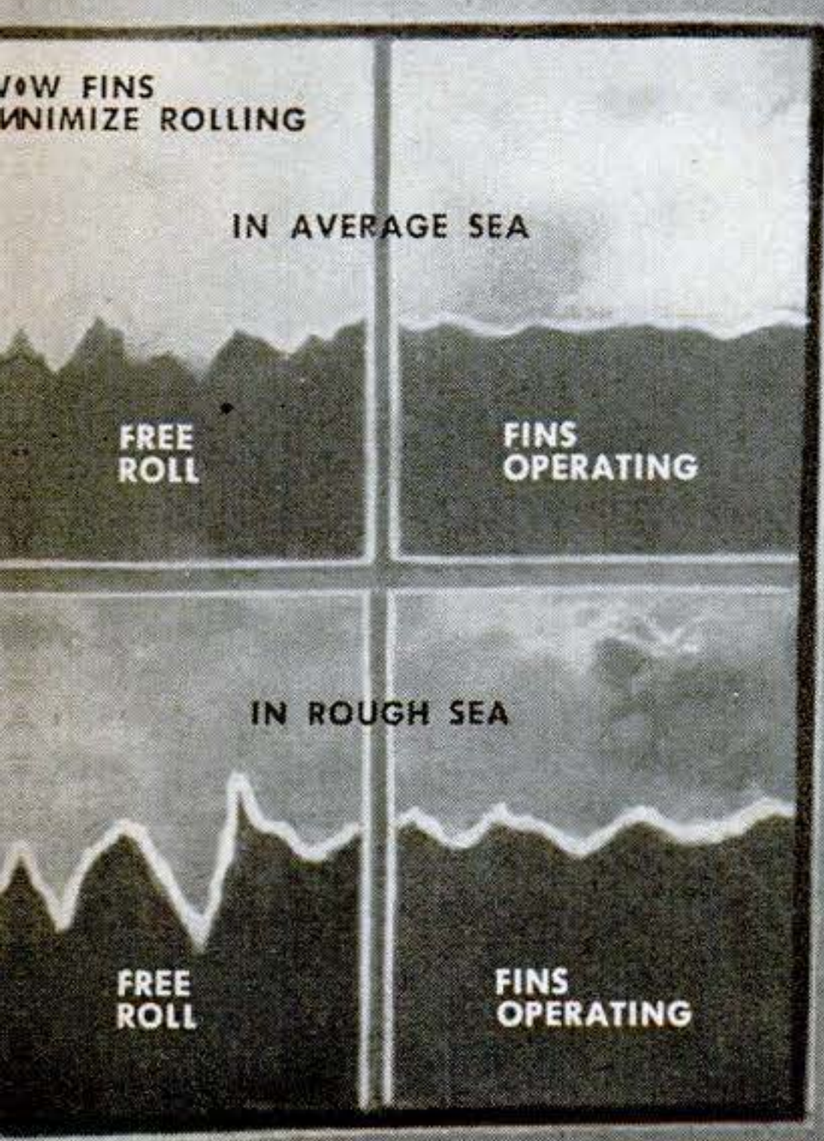
Biggest Liner Sprouts Fins

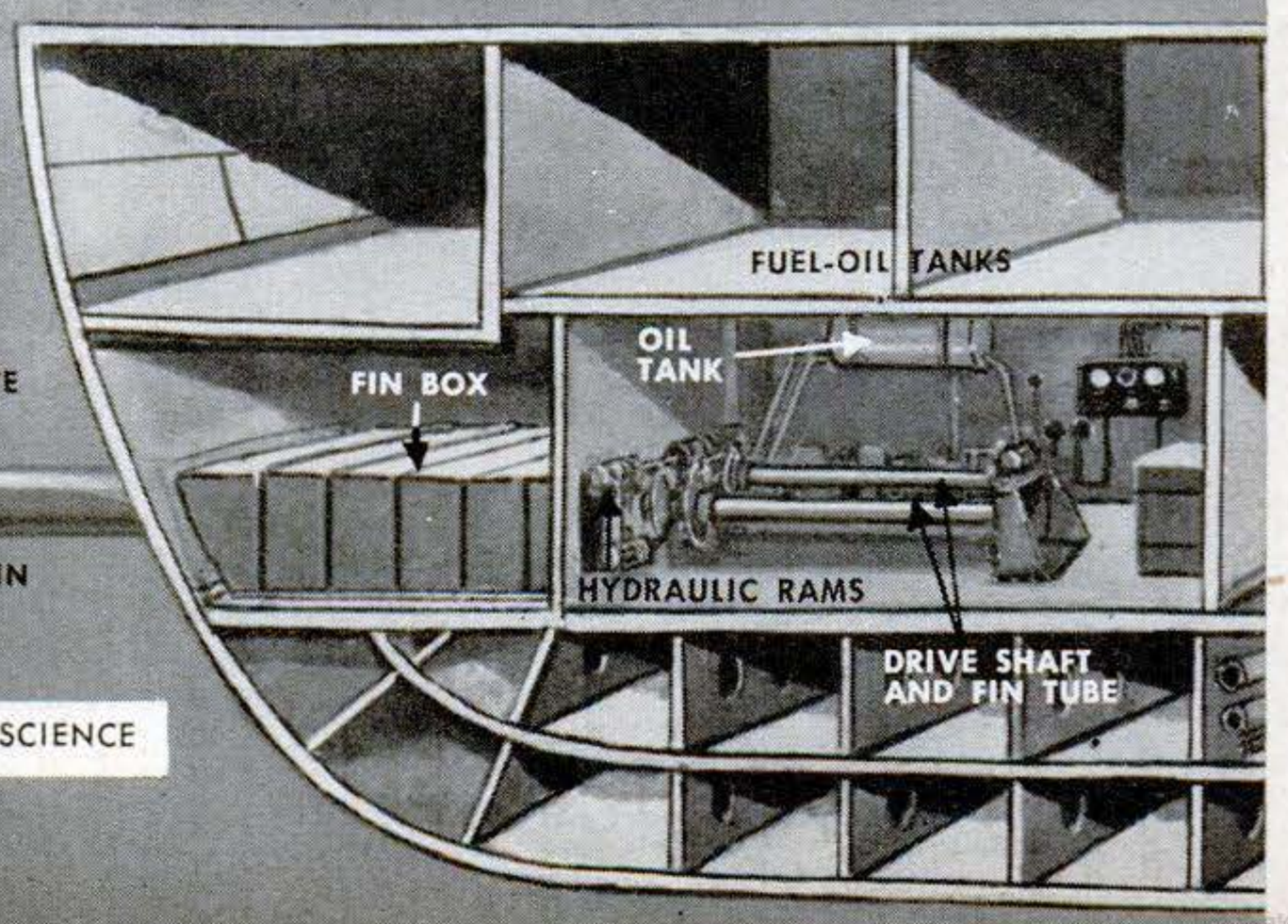






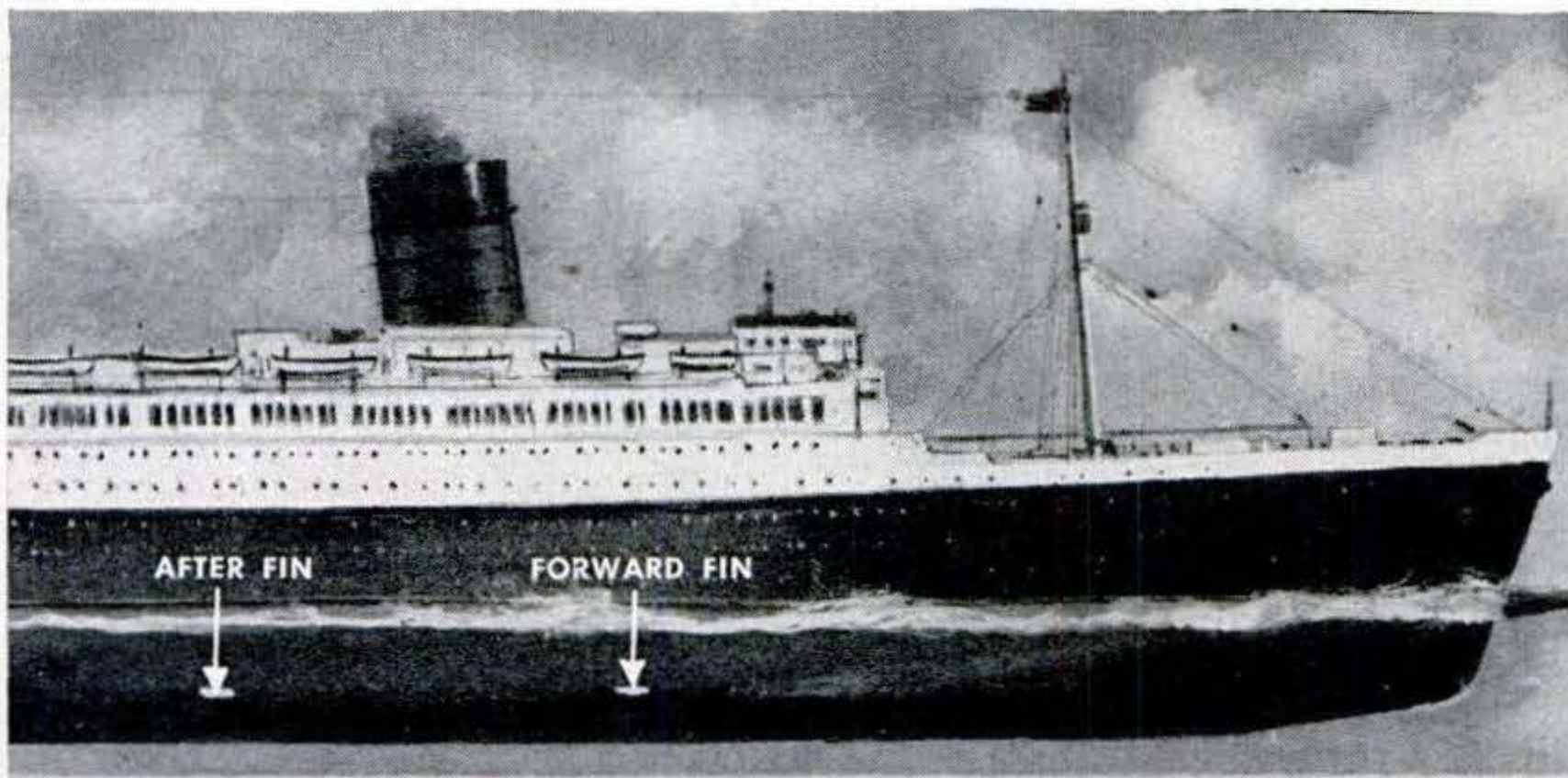
SIMPLIFIED DIAGRAMS SHOW FINS' MECHANISM. HYDRAULIC RAMS OPERATE, IN TURN, DRIVING CROSSHEAD; HEXAG-

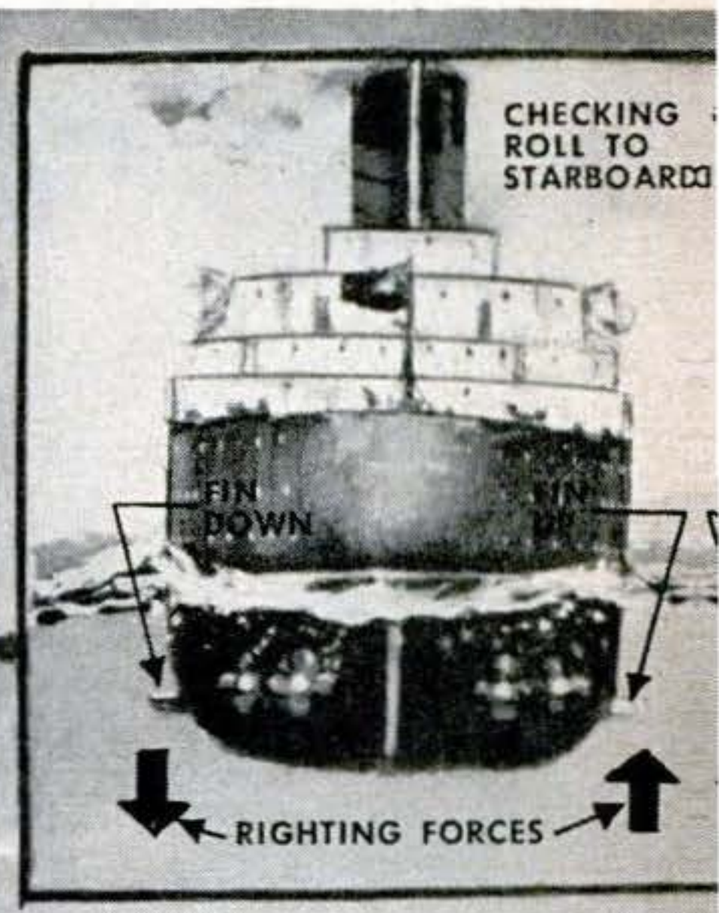


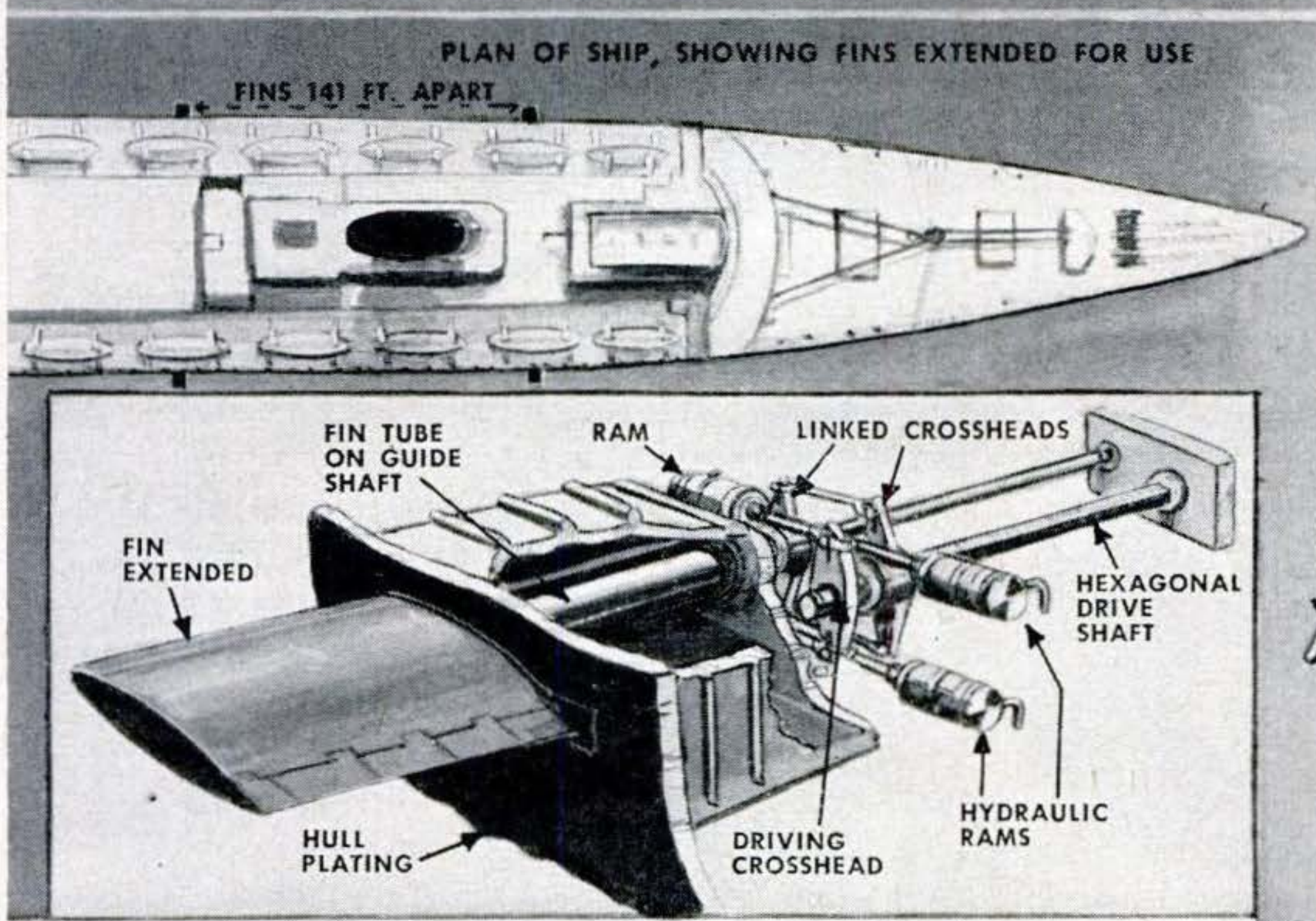


UNDERWATER fins now steady the world's largest ocean liner against rolling when waves buffet her and the salt spray dashes high. To smooth rough seas for passengers, the 987-foot, 83,600-ton *Queen Elizabeth* was equipped with her new "flippers" during her last annual overhaul in drydock at Southampton, England.

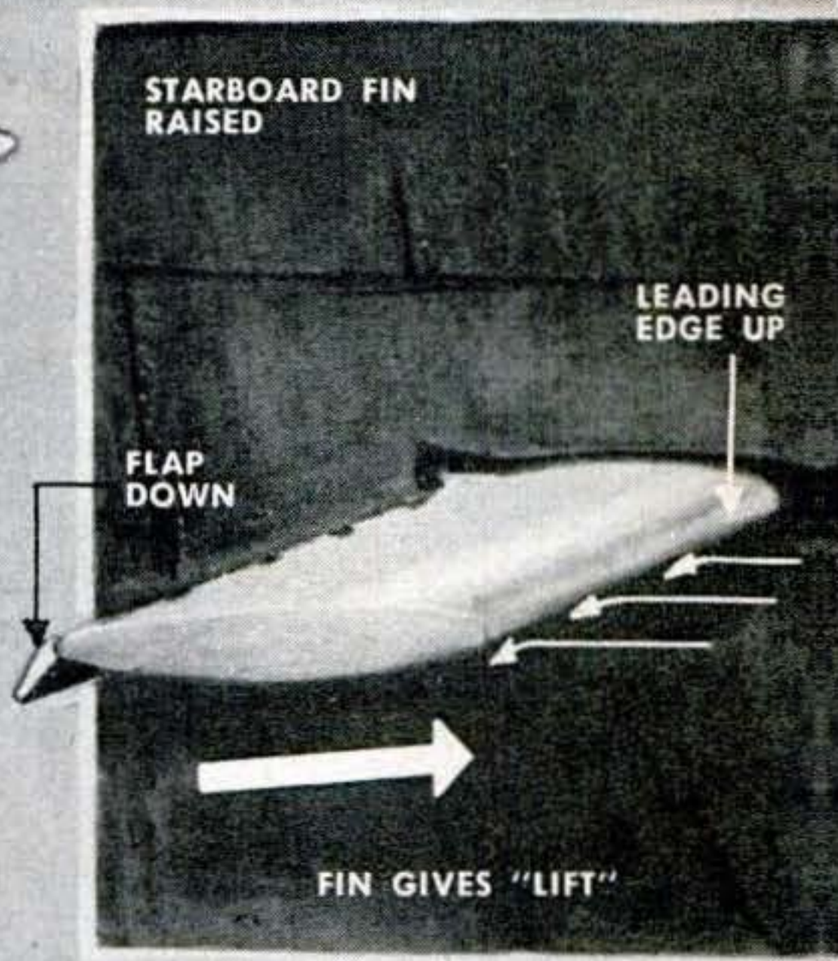
Antirolling fins have proven their

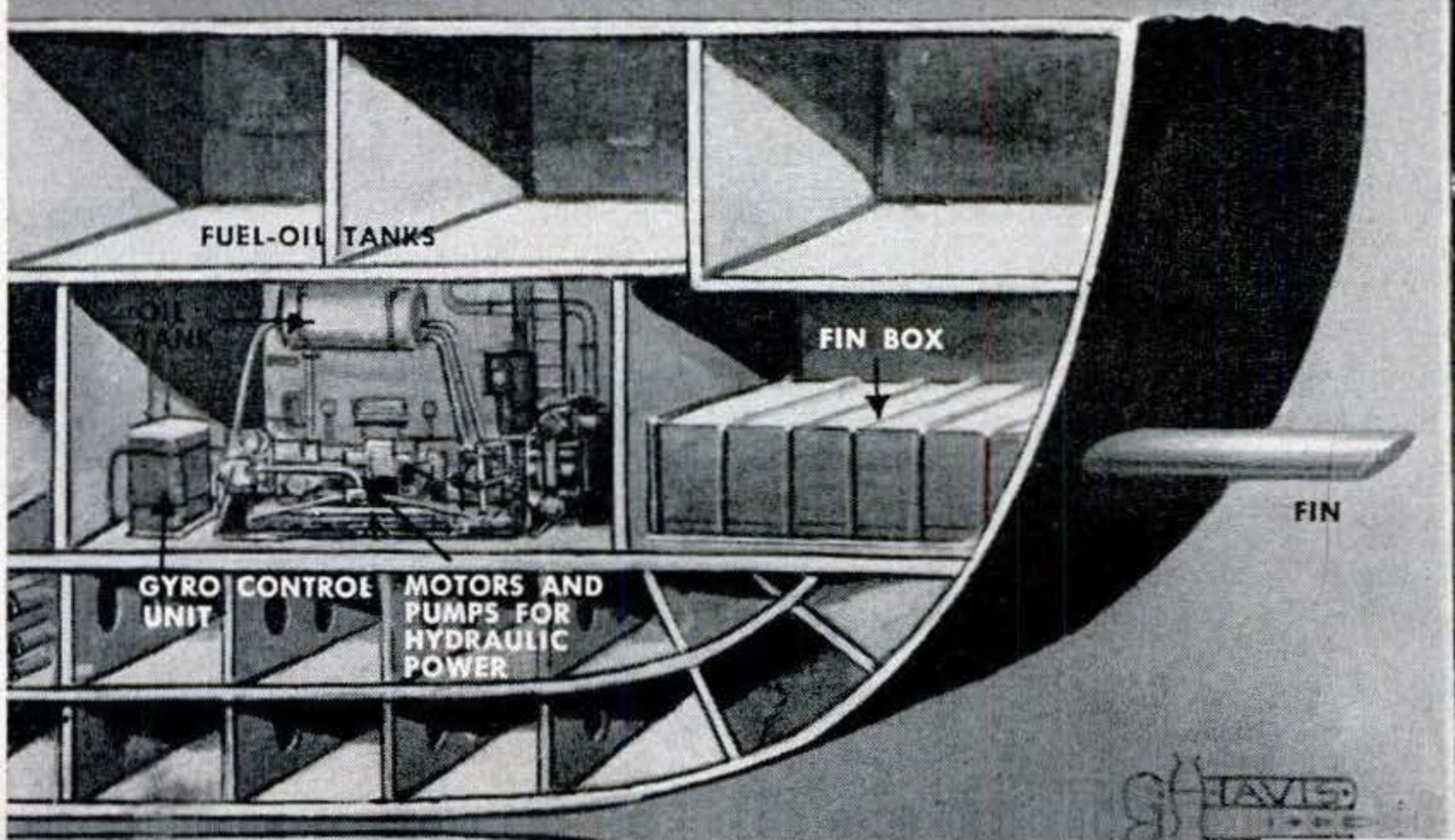


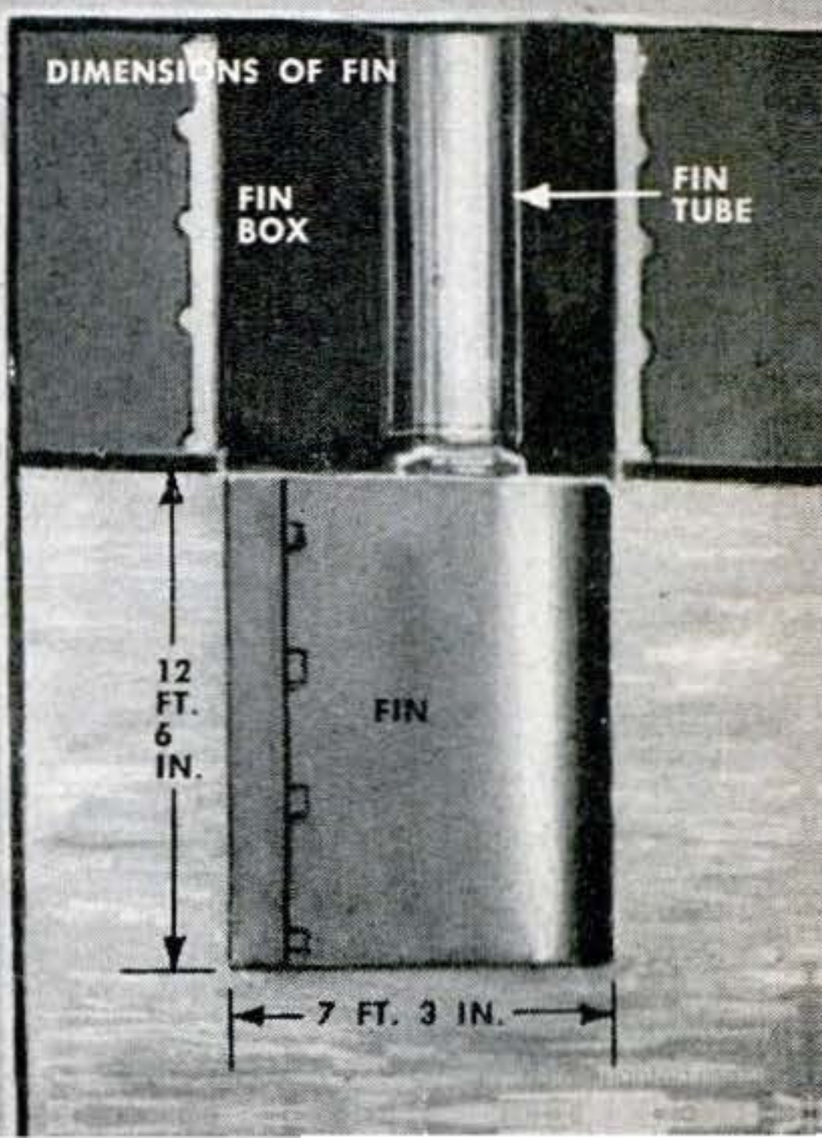


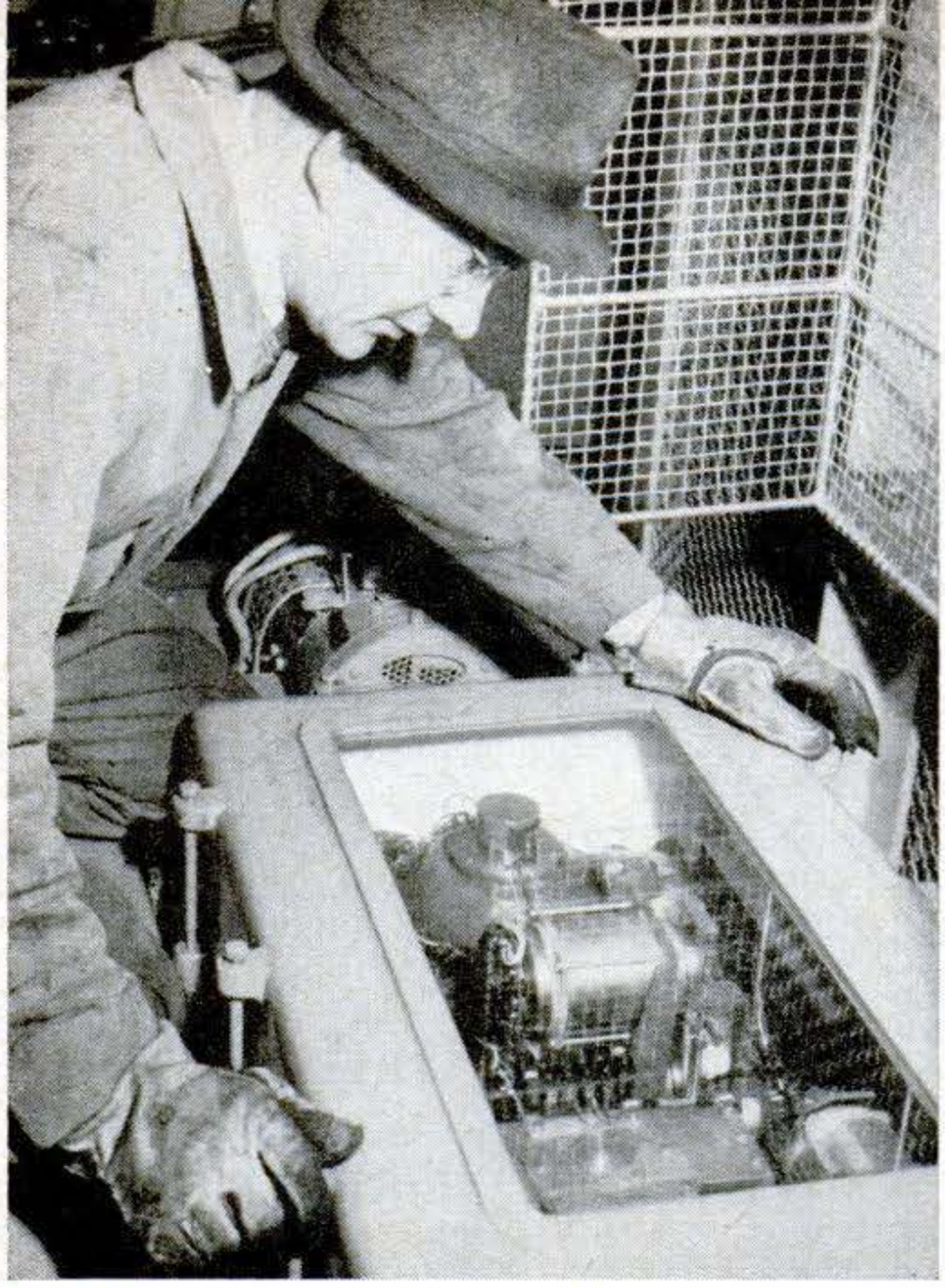


ONAL DRIVE SHAFT; LINKED CROSSHEADS; AND FIN TUBE, TURNING THE FIN. ARRANGEMENT PERMITS RETRACTING FINS.

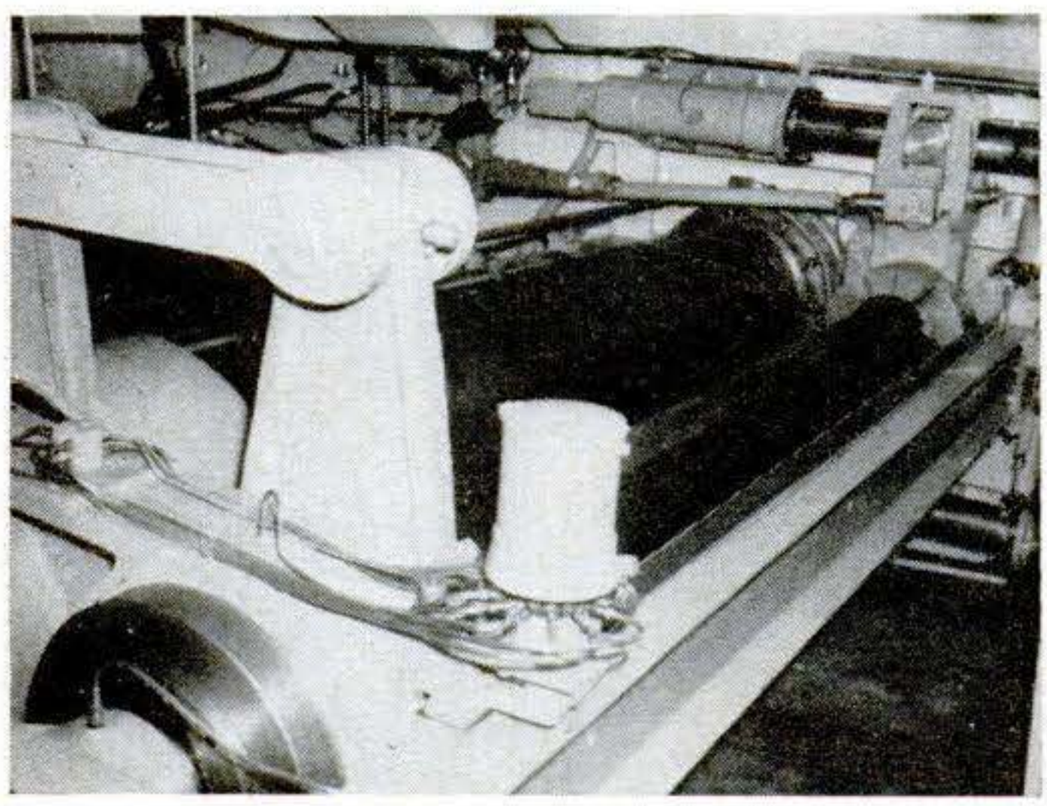








BRAIN of ship stabilizer, a gyro in this glass-topped case, senses the beginning of a roll. Automatically it actuates hydraulic rams that tilt fins to apply righting forces.



MUSCLES of stabilizer, hydraulic rams on far wall, turn hexagonal shaft to swing massive crosshead in foreground and rotate larger round shaft, beyond it, of one of ship's fins.

worth on many a smaller vessel, over nearly two decades, but never before have they been fitted to one approaching the great Cunarder's size. The *Queen Elizabeth* has four fins; all previous installations consisted of two.

Drawings on the preceding pages by a British artist show how the *Queen's* fins work. Each measures more than 12 feet long and seven feet wide, looks like a stubby airplane wing, and may be turned through a maximum angle of 40 degrees by the massive tubular shaft on which it is mounted.

In operating position, the fins extend outward from the hull, and hydraulic rams tilt them to plane upward or downward through the water. A gyroscope a few inches high actuates a set's hydraulic mechanism automatically.

If the ship starts rolling to starboard, the free-swinging gyro "senses" the deviation from vertical and acts to correct it. Tilting upward, the two starboard fins exert a lifting force. The two port fins, depressed, apply a downthrust. This combination of righting forces checks the ship's rolling.

Similarly, elevating the port fins and lowering the starboard ones counteracts rolling toward the port side.

When seas are calm, the fins are retracted into "fin boxes," watertight compartments that form inward extensions of the ship's hull.

Making voyagers more comfortable is not the only advantage of minimizing rolling. It eases stresses and strains on vessels as well as passengers. And warships that don't roll make steadier and better gun platforms.

All these incentives have spurred efforts to devise antirolling measures. First notable success resulted from installing a great gyroscope, spinning on a vertical axis, at the centerline of a ship; its resistance to tilting checked rolling. Early installations were on ocean-going yachts, but by 1932 this system had been installed on a ship as big as the 48,000-ton Italian liner *Conti di Savoia,* using three huge 100-ton gyroscopes with rotors 13 feet in diameter.

Then came the idea of the antirolling fins, designed by a British ship-machinery firm and first tried out on an English Channel steamer in 1936. They have since been adopted for 174 craft including ocean liners, a British cruiser and a number of destroyers. The Peninsular and Orient liners *Arcadia* and *Iberia,* of about 29,000 tons each, were the largest vessels equipped with the fins until the record-breaking installation on the *Queen Elizabeth.* END

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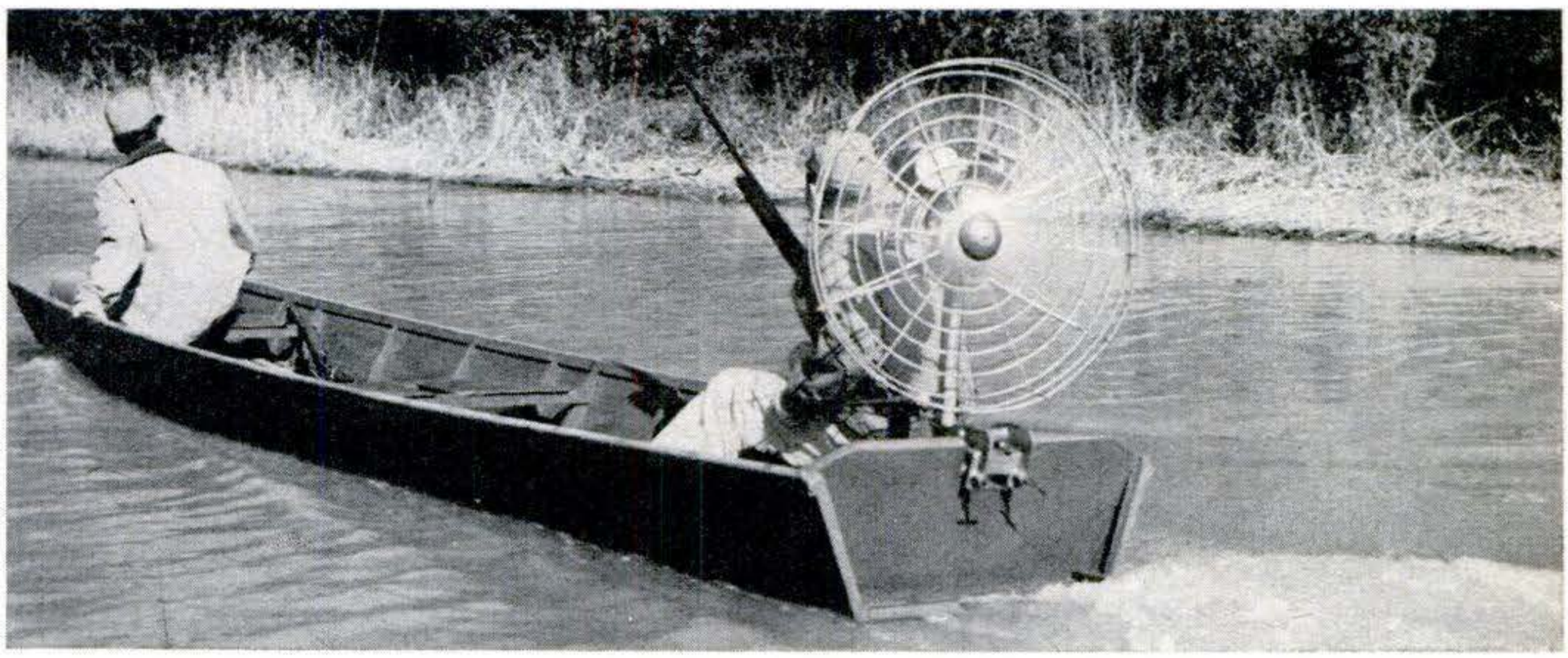
Device Counts Germs, May Also Track Source of Smog

INSTANT warning of an enemy germ-warfare attack would be given by this apparatus. It measures and counts microscopic airborne germs, dust and moisture particles. The inventor, Nelson E. Alexander of the Army Chemical Corps, says that the "aerosoloscope" can be used to analyze contaminated air in industrial areas.



Air Propeller Is Attached to Boat Like an Outboard Motor

HUNTING or fishing in shallow waters presents no problem to a boat powered by this air-drive motor. Not even a rudder projects under water since steering is by air, too. It fits any craft that will take an ordinary outboard. The Airboy, made by Airboats, Inc., Box 2255, St. Louis, comes in two sizes priced at $179 and $215.

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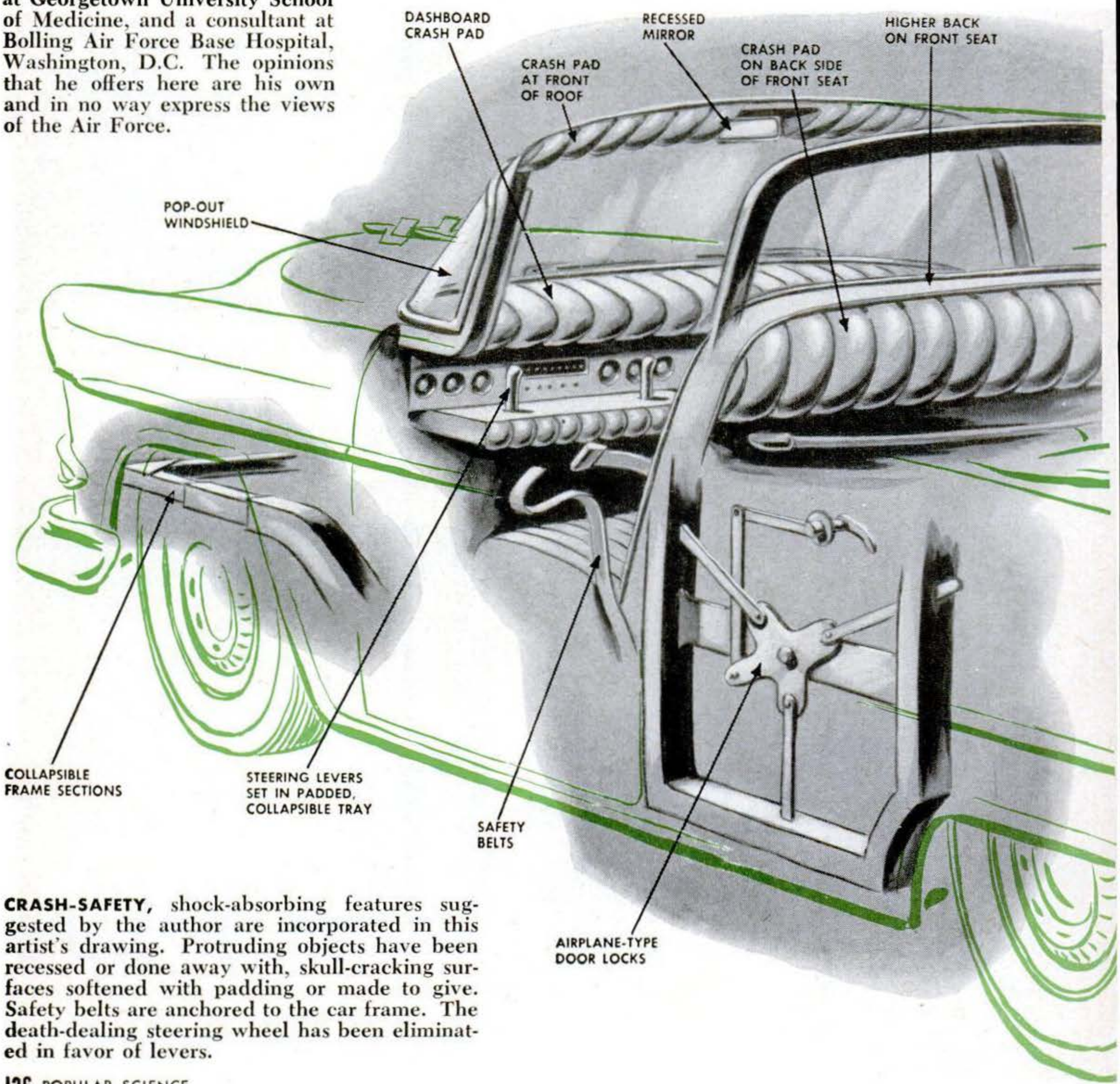
DOCTOR WENGER, a colonel in the Medical Corps, U.S. Air Force, is a consultant in surgery to The Surgeon General, USAF, an associate professor of clinical surgery at Georgetown University School of Medicine, and a consultant at Bolling Air Force Base Hospital, Washington, D.C. The opinions that he offers here are his own and in no way express the views of the Air Force.

He'd like to see 'em make

The big killer in crashes is the abrupt end of speed. Here an Air Force doctor tells how he would prevent accident victims from being hurled to death.



CRASH-SAFETY, shock-absorbing features suggested by the author are incorporated in this artist's drawing. Protruding objects have been recessed or done away with, skull-cracking surfaces softened with padding or made to give. Safety belts are anchored to the car frame. The death-dealing steering wheel has been eliminated in favor of levers.

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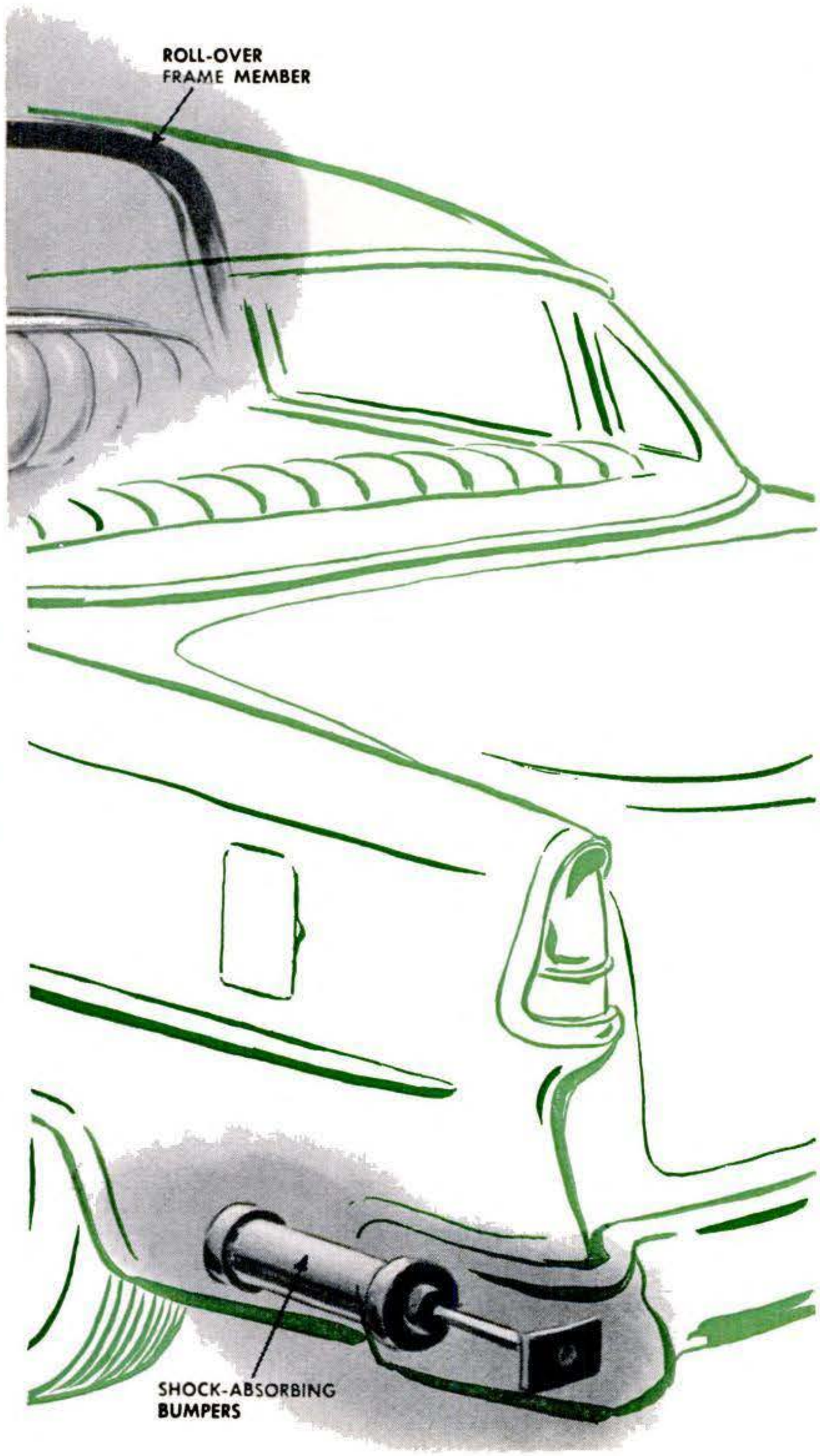
Safer Cars

By Col. Don S. Wenger

AS LONG as machines fail and human beings make mistakes, there will be auto accidents. But, since there are going to be crashes, can't we have safer crashes?

This problem is different from accident prevention. It begins where accident prevention falls short of its goal.



During the last few years, official and private organizations have begun to tackle it. The U.S. Air Force is vitally interested because 88 percent of all deaths occurring among Air Force personnel are due to crashes—and one-half of the crash victims are killed in cars.

Practically all studies reveal one startling fact: In a car wreck a person is more likely to be dashed to death than crushed to death. You might think that inside the steel shell of your car you are well protected. Actually, in a sudden stop you are about as safe as a china cup bounced around in a barrel.

Engineers studying fatal car accidents in Indiana in 1951 found that at least two-thirds of the victims died because they were hurled against hard objects. On a national scale this would mean that every year sudden stops kill more than 25,000 men, women and children.

It is not just the speed that kills them. It is the abrupt end of speed—the car's deceleration from, say, 60 miles an hour to zero in practically no time at all. For a fraction of a second the people in the car continue to shoot forward at 60 miles an hour. Then they stop, too, as they are smashed against unyielding glass or metal.

The emphasis is on "unyielding." Soft objects seldom inflict injuries. Few people are hurt in pillow fights. A pillow yields; deceleration is slow; and the force behind the pillow is spread over a large surface. The story is different if we take a brick instead of a pillow—and many of a car's inside surfaces are very much like bricks.

I believe that automobiles with less

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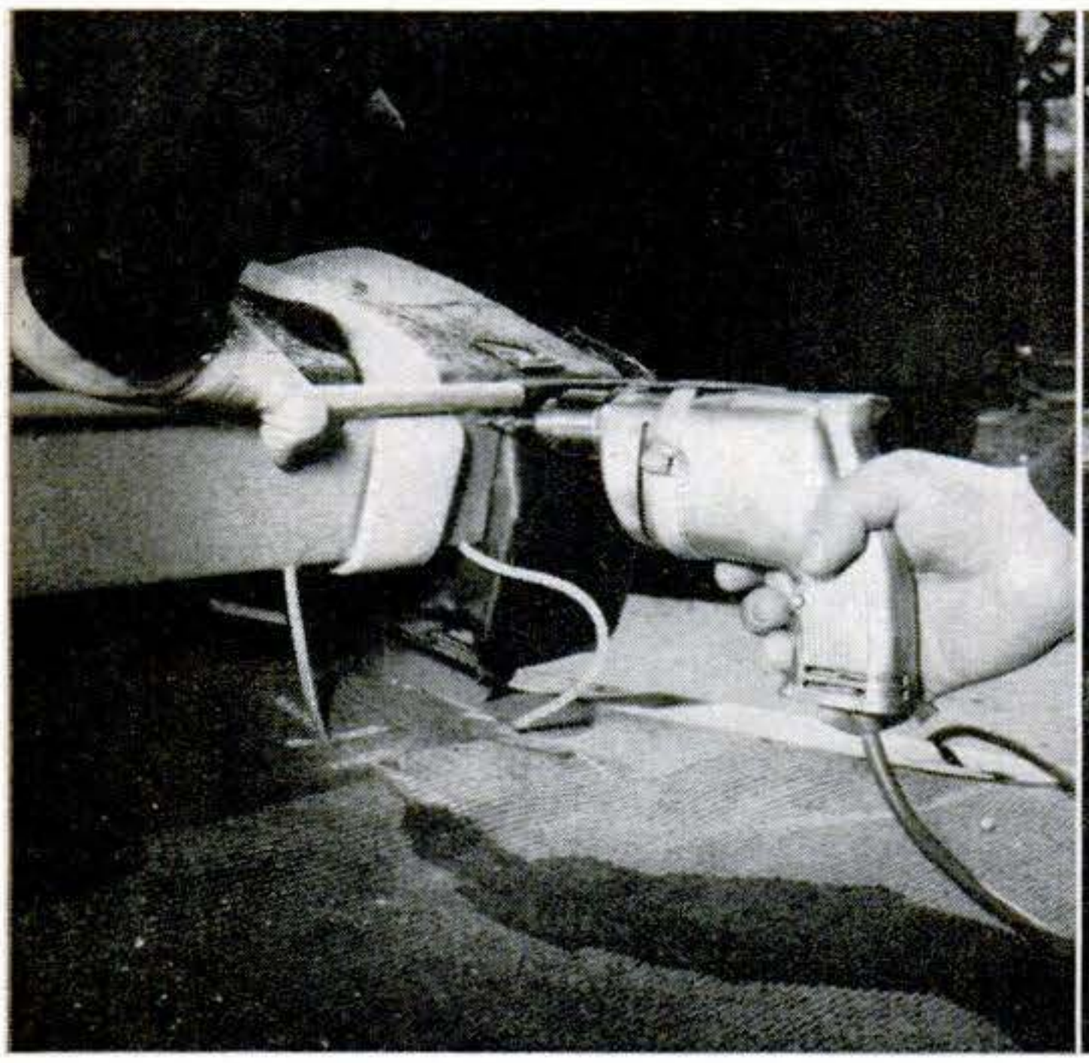
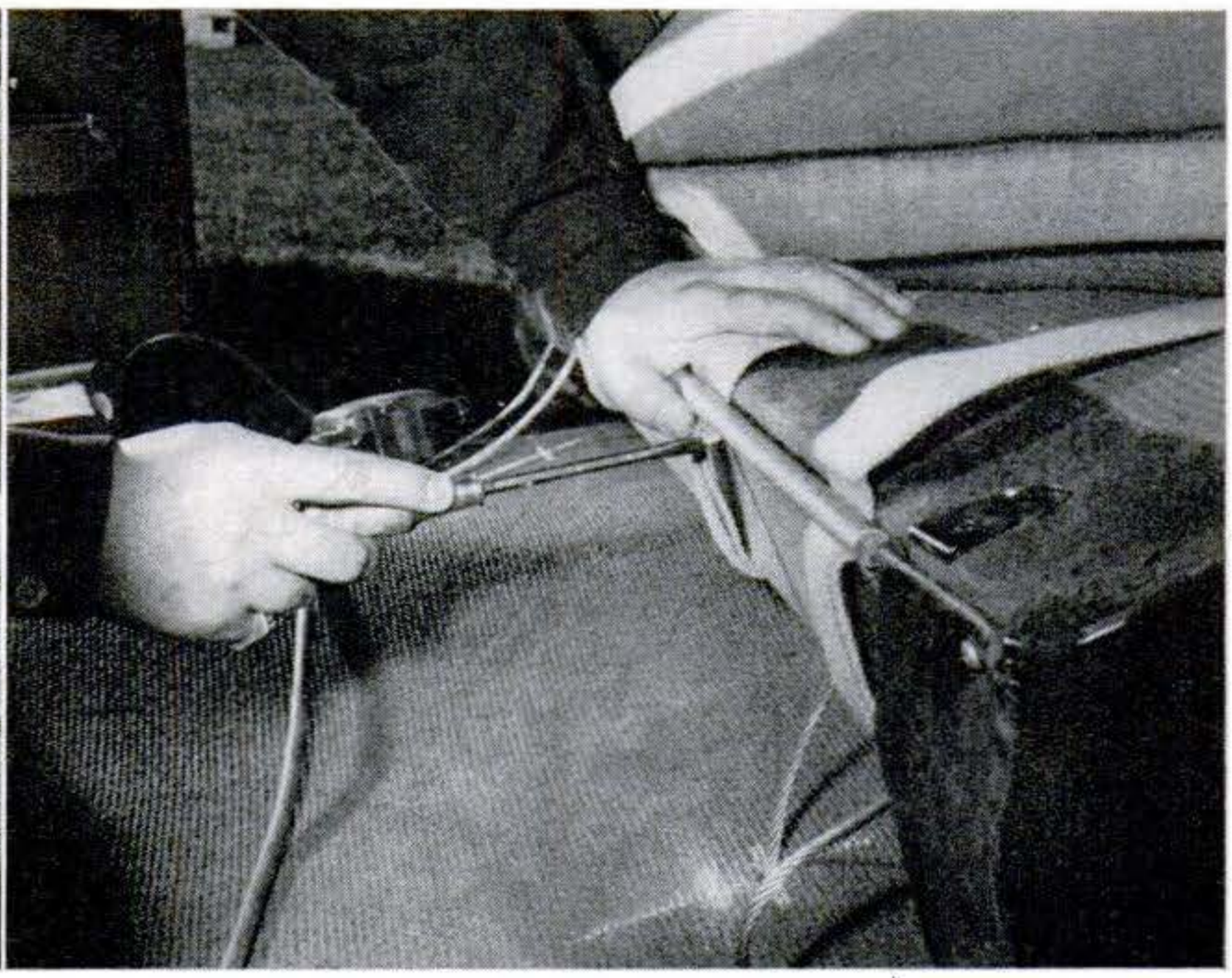
Kits make car safety belts easy to install

1 ALUMINUM BAR, shaped to fit the recess under the back of the front seat, is cut to size. To keep the bar properly centered, half of excess length is sawed from each end. Cuts are smoothed with a metal file.

2 DISTANCES from car side to near and far edges of frame have been measured underneath the car. Here these measurements are marked off with chalk on the car floor. This is repeated for the other side of the car.



5 THE BAR HAS HOLES for drilling into the seat frame. This is done with a No. 20 drill while holding edge of the bar flush with the seat frame. Holes at ends are drilled first, and self-tapping screws inserted.



6 WITH THE BAR HELD SECURELY in place by the two end screws, drilling into the seat frame is done through the remaining holes located along the top edge of the bar. Then screws are put in, as shown above.

lethal interiors can and should be built.

The most commonly heard arguments against the introduction of certain safety features are, first, that they cost too much and the public wouldn't buy them; and second, that there is no real demand for cars specifically designed for safety.

Each argument can be rejected. Many of the safety features I have in mind cost less than chromium strips, whitewall tires or two-tone paint jobs. And cost, even if it were great, should not be weighed against human lives. Nor would I worry too much about the alleged lack of popular demand. There never was much demand for, let's say, a hardtop convertible—before someone in the industry thought of a hardtop convertible and sold it to the public. Promotion can sell safety, too.

One feature of the car I would like to see changed is the steering mechanism. In a crash, today's steering column may impale the driver; the spokes of the wheel may crush his chest; the hard rim

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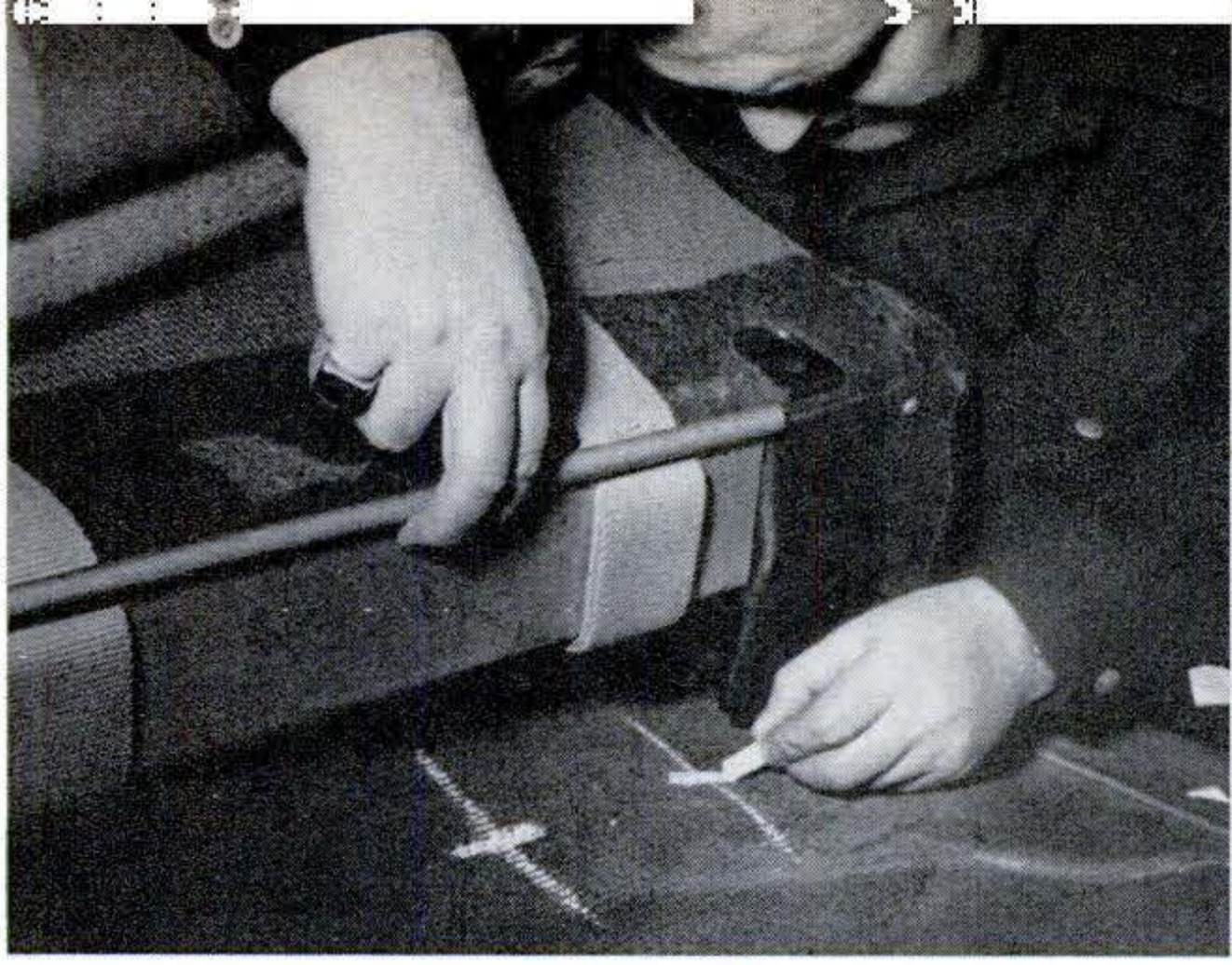
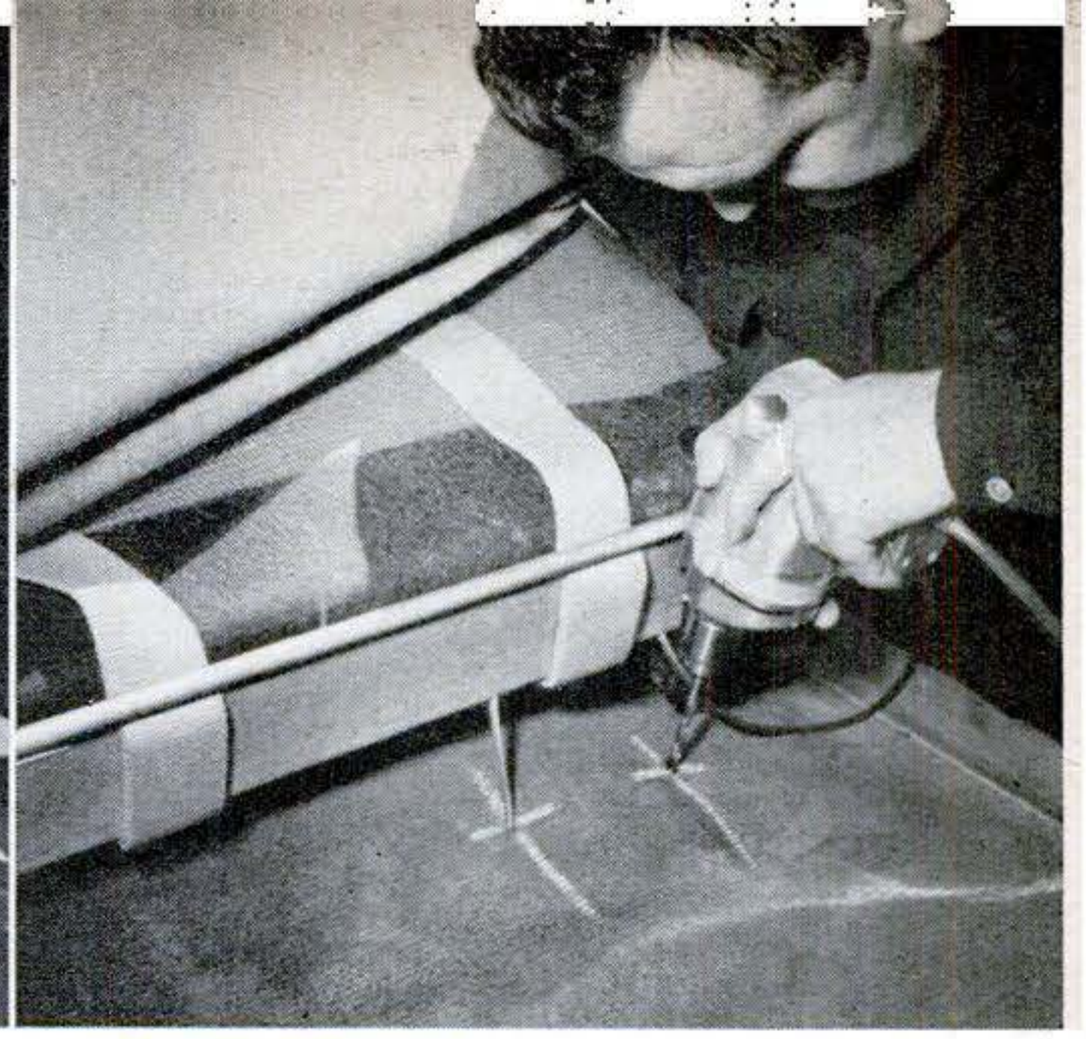
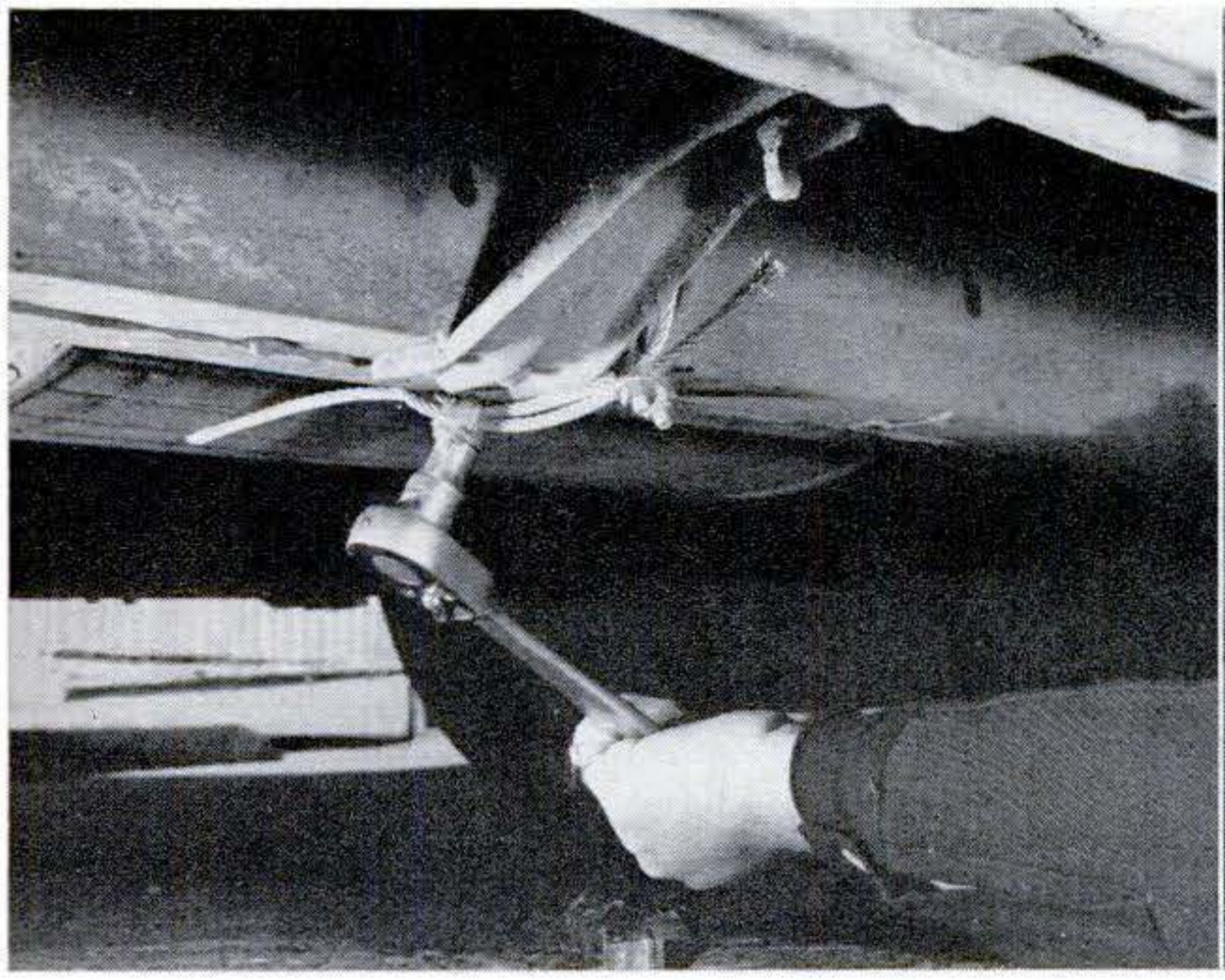


3 WITH THE FRONT SEAT in mid-position, the bar is inserted and held in the seat recess. Then, on the frame-location lines, hole positions are marked directly below the bar. This, too, is repeated for the other side.



4 SEAT IS FORWARD as holes are drilled with a ¼" bit. An underneath check is made first to be sure holes will clear frame and fuel lines. Next, cable is threaded through holes in the bar and through the floor holes.



7 UNDERNEATH THE CAR, cables, arranged so as not to rub against fuel or brake lines, are pulled taut through wire clamps. Ratchet wrench is used to tighten clamps. If cable ends are too long, they can be taped back.

8 QUICK-RELEASE, airplane-type buckles are simple to adjust. The car safety belt kit shown being assembled in these photos is made by the Hickok Mfg. Co., Rochester, N. Y. It is one of several now on the market.

may fracture his skull as his body jack-knifes.

For years, safer steering mechanisms have been suggested. Some would collapse or telescope under the impact of a body. Or the steering wheel would be heavily cushioned. A suggestion has been made, too, which would eliminate both the steering wheel and the column, replacing them with levers.

Hinged steering wheels and similar arrangements are found in several makes of racing cars. They certainly have proved their reliability on roads and tracks.

Next I would like to see the windshield modified. Catapulted forward in a crash, the occupant of the car runs the risk of having his throat cut. One popular solution is the windshield that pops out when hit hard from the inside.

Designing such a windshield would pose formidable engineering problems, but I believe they could be solved. At

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least one car manufacturer has tried a pop-out windshield.

Another solution might be a transparent plastic windshield, more yielding than glass. So far no satisfactory plastic has been developed; present plastics get scratched up and become a hazard because of decreased visibility.

The rear-view mirror is next on my list. When in a sudden stop the rear of the car humps up, a person may shoot forward and up—into the mirror. Some people in the automobile industry have said that the mirror has saved more lives than it has destroyed, but why should a mirror destroy any lives at all?

I suggest that the mirror be recessed, which would remove its striking edges, or that it be removed altogether and replaced by outside mirrors.

There is plenty of room for improvement on the dashboard. Some of its protruding knobs have disappeared but not enough. I suggest that they all be recessed and that a good padding be put over the dashboard. Some cars have been made with a two-inch foam rubber padding on the dash, but two inches isn't enough. Some safety experts recommend four inches of foam rubber.

Automobile doors must be redesigned. When they fly open in a crash, the occupants are likely to be smashed to death on the road. This fact is not widely enough known. Time and again I have seen newspaper stories which said: "X escaped death because he was thrown clear." Such a statement must be read with a great deal of skepticism. In most cases, X's chances of survival would have been better if he had not been thrown clear.

Automobile doors might be built like airplane doors, with three or four lugs holding the door shut in several directions at the same time. In a crash, at least one or two lugs will hold.

I would make the back of the front seats high enough to protect heads and necks from "whiplash" injuries in which the head is jerked backward and the person, trying to compensate by a forward movement, injures his neck muscles.

The rear seats could be made safer by crash-padding the back of the front seats.

I would strengthen the roof with a roll-over bar—a metal rib that keeps the roof from being crushed when the car rolls over. For obvious reasons, I would crash-pad the front part of the roof too.

The bumper design definitely needs improvements. There should be, instead of today's bumper construction, some type of energy-consuming shock absorber, possibly patterned on the "oleo" shock absorber used in aircraft.

I would borrow still another idea from airplanes: collapsible frame sections. These are designed to fold up, accordion fashion, under a predetermined stress. Several schemes are possible. One of them may be suggested by a series of tests conducted at the University of California. Scientists there have put the trunk compartment between the bumper and the front seat. In a crash stop the trunk compartment would fold up.

But do we really have to wait until Detroit is ready to make cars as safe as they should be? One important but simple feature can be added to your car right now: a safety belt.

To be effective, this belt must be anchored to the frame of the car. If it is fastened to the seat, the seat must be anchored. Little would be gained if a person tied himself to a seat and the seat itself shot forward in a crash. Properly used, the belt may prevent injuries even in a bad wreck.

The value of the seat belt has been most impressively shown in plane accidents. I remember the case of a B-17 crash. Much of the cabin structure remained intact. In one compartment of the plane, four people had been sitting. Three of them had failed to put on their safety belts. These three were dashed to death. The fourth had fastened his safety belt. He lived.

Some people used to believe that a

[Continued on page 252]

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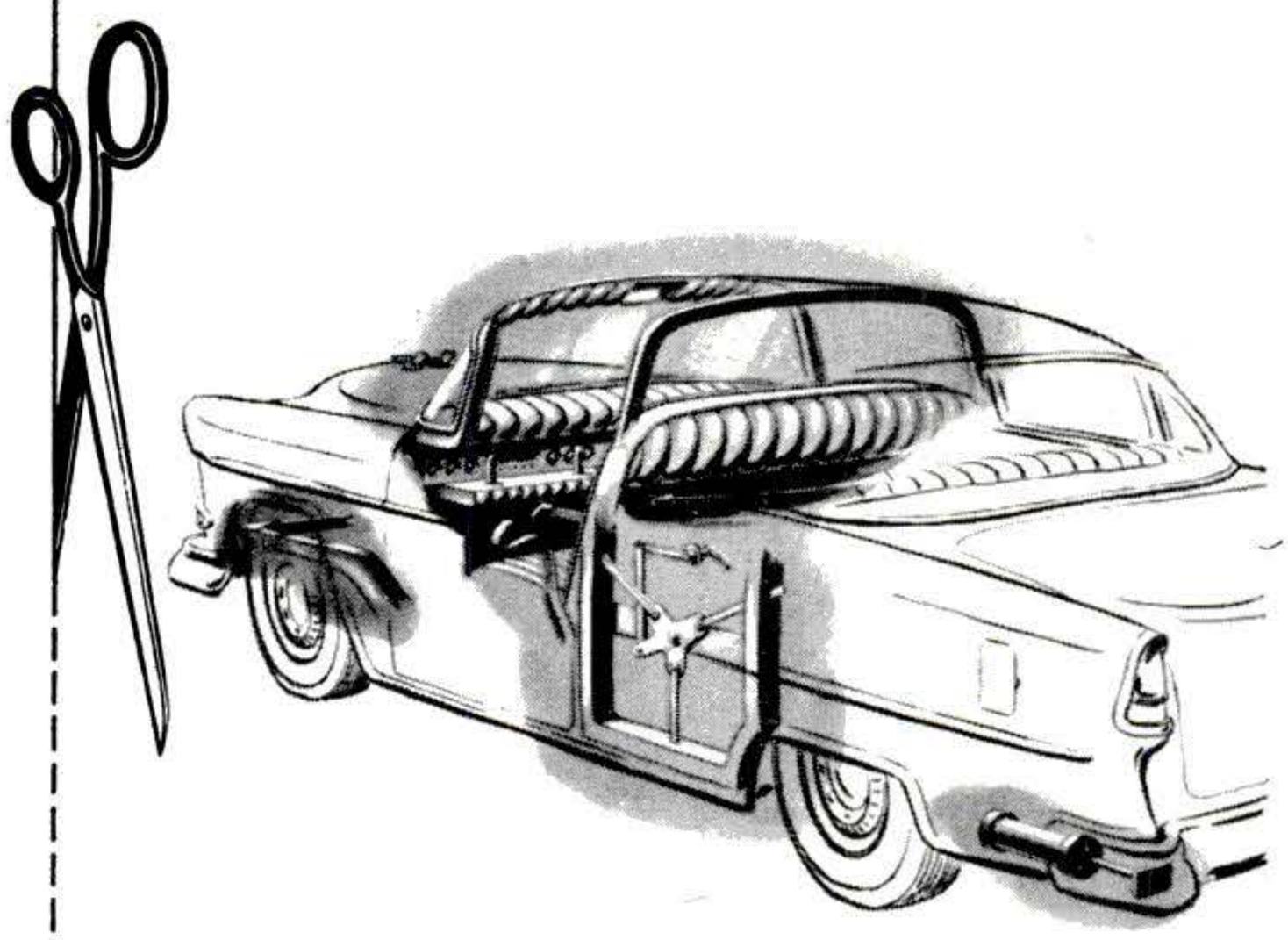

Tell the Auto Makers What YOU Want

IN THE article that precedes this ballot, Col. Don S. Wenger points out ways in which cars could be made safer.

Detroit manufacturers say they build what the public wants. They make elaborate surveys of public opinion and study sales records to determine what American motorists go for. But has anyone ever asked you whether you would prefer features such as Colonel Wenger proposes to those now available on most cars?

Here's YOUR CHANCE to express YOUR OPINION.

Listed below are 20 items. Some of them are available on Detroit cars now; others are not. Which 10 would you prefer to have on your next new car?

Check 10 items like this ☒ Please do not check more than 10

- ☐ **1. Pop-out windshield**
- ☐ **2. Whitewall tires**
- ☐ **3. Crash-padding on dash**
- ☐ **4. Nylon upholstery**
- ☐ **5. Collapsible steering column**
- ☐ **6. Built-in ash trays**
- ☐ **7. Recessed rear-view mirror**
- ☐ **8. Car radio**
- ☐ **9. Padded steering wheel**
- ☐ **10. Electric window lifts**
- ☐ **11. Shock-absorbing bumpers**
- ☐ **12. Air conditioning**
- ☐ **13. Lighted glove compartment**
- ☐ **14. Higher back on front seat**
- ☐ **15. Safety belts**
- ☐ **16. Chromium trim**
- ☐ **17. Airplane-type frame**
- ☐ **18. Two-tone paint job**
- ☐ **19. Airplane-type doors**
- ☐ **20. Electric clock**

Your Name:_____ Age:_____

Address:_____

Now, clip out this page and mail it, by July 1, 1955, to:

The Auto Editor, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

You'll find the results of this survey in a future issue of POPULAR SCIENCE MONTHLY.

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Ejector Seat Lets Pilot Abandon Ship on Ground

SAFE parachute jumps from no altitude at all are promised by a new British ejection seat. In the test above, a dummy floated to earth after being shot 75 feet up from a plane taxiing on the ground at 100 m.p.h. The seat is expected to give jet pilots an emergency exit when hedgehopping, or even on landing or taking off.

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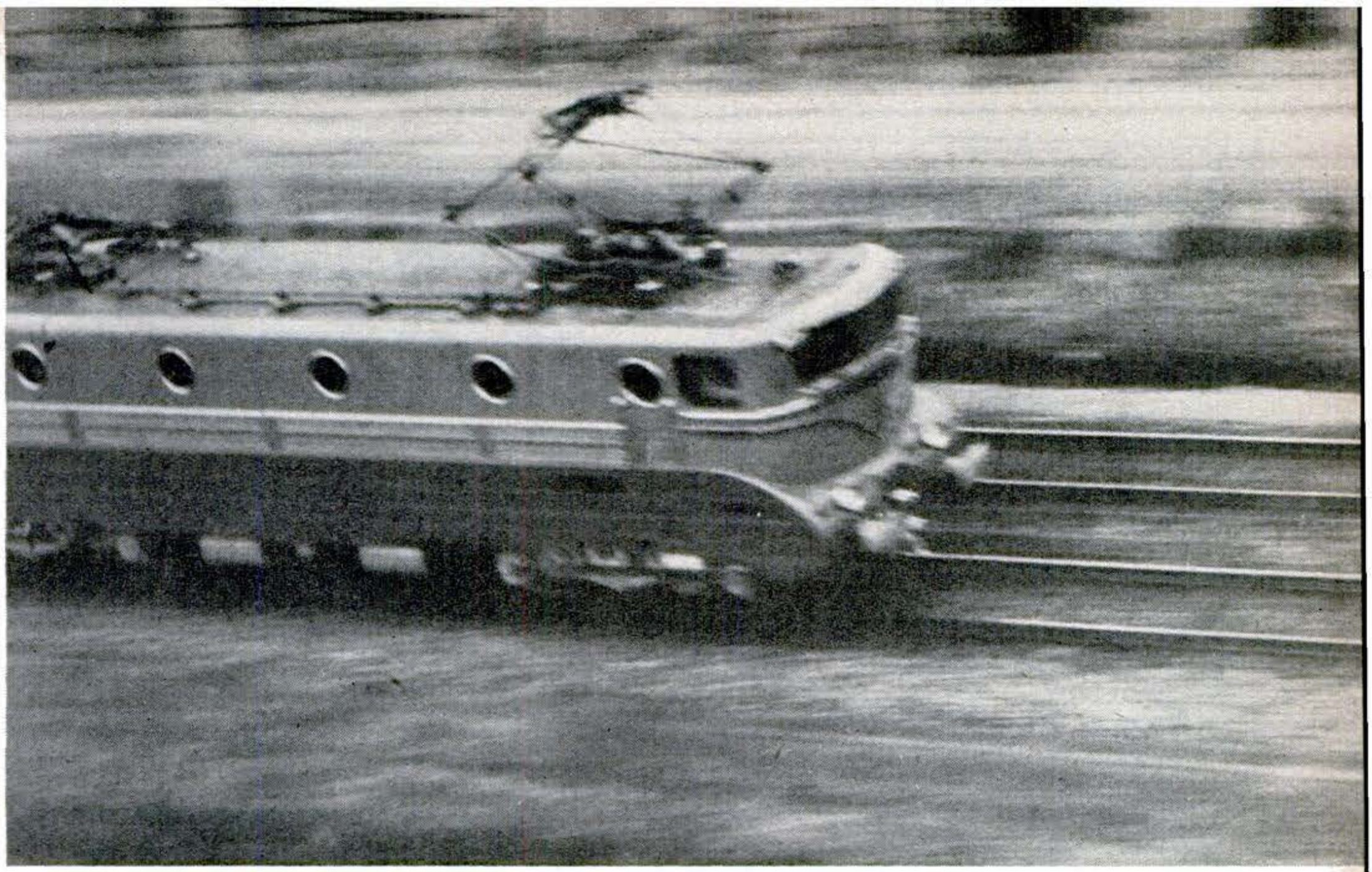

French Train Hurtles 207 M.P.H. to Set New Speed Record

THE French locomotive above was snapped in the act of smashing the world's railroad speed record. Using juice sucked in by the high-speed pantograph on top, the 12,000-hp. electric engine pulled three cars at a dizzying 207 m.p.h. To slow it down to a safe braking speed, the car windows were opened to create drag.

Diving Lung Adjusts to Water's Depth

A NEW air lung, pictured in use at right, needs no calibration but automatically hikes air pressure as the diver encounters increased water pressure in his descent. A metering valve operated by a diaphragm regulates the air flow.

When set for surface swimming, the mouthpiece valve closes off the breathing hoses to prevent flooding and save compressed air while the diver breathes in the normal fashion.

The Garrett Corp., Los Angeles, makes the Northill lung, which has been okayed for use by Navy frogmen.

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New Library Engineered to Make Borrowing Easy

THE New Look in libraries opened in Cincinnati recently. A $3,250,000 steel-and-glass structure, completely air-conditioned, it is designed more like a department store than a public building.

It operates that way, too, with facilities planned for efficient service.

Special machines help you borrow books quickly and easily—and you can even return them without getting out of your car.

You can enjoy records and films almost as easily. High-fidelity equipment pipes recordings to any of five locations in the building. Playback machines equipped with earphones enable record borrowers to hear recordings before checking them out. The library also has two auditoriums and a special children's section with a soundproof story-telling room.

Scholars researching among the library's 1,250,000 volumes get extra attention. There are 16 private "study rooms" for individual use. A researcher can spread out his papers, set up his typewriter or tape recorder and have books sent directly to him there. He even gets a key so that he can lock his room while he slips out for a quick lunch.

The building has three main floors, with four additional levels (beneath the first floor and between the second and third floors) for book stacks. Cork flooring and acoustically treated ceilings maintain a library's traditional quiet, while window walls make rooms bright.

RECORDINGS CENTER has 13,000 records available for loan. Playback equipment, which lets you preview your selection, gets a tryout below from Woody Garber (left), library architect.

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VERTICAL BLINDS control daylighting in this library room, which overlooks garden. Window in Memorial Room for rare books has 19-foot stainless-steel louvers that are motor-operated.

TO SPEED BORROWING, Cincinnati library uses a microfilming machine at the check-out desk. It photographs borrower's card and book card.

BOOK RETURN is mechanized, too. Librarian drops the book onto a conveyor belt which feeds it to a sorting table in one of the storage rooms.

PNEUMATIC TUBES provide fast service. Girl at right below takes order messages from small tubes; girl at left puts book into delivery tube. END

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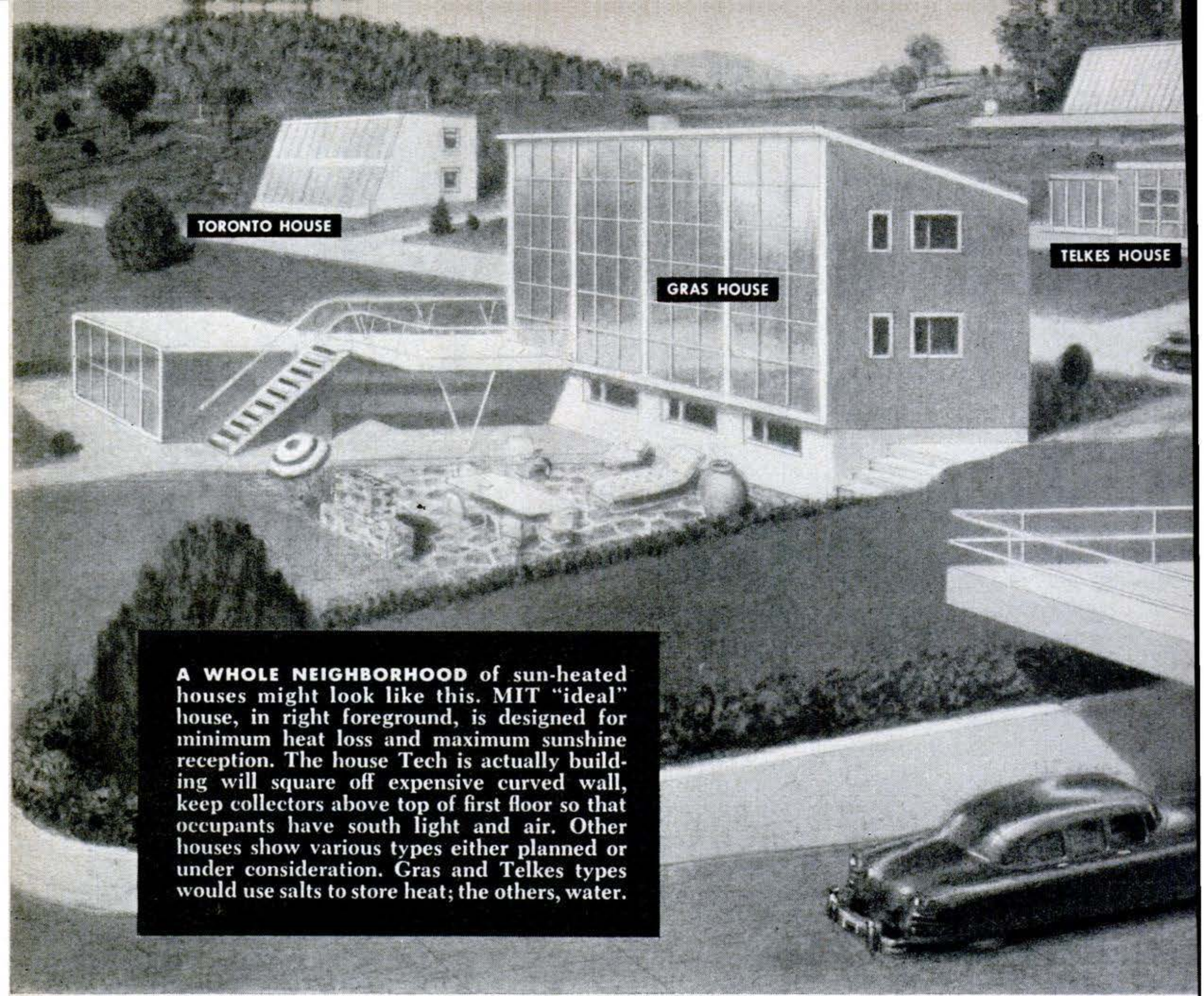

A WHOLE NEIGHBORHOOD of sun-heated houses might look like this. MIT "ideal" house, in right foreground, is designed for minimum heat loss and maximum sunshine reception. The house Tech is actually building will square off expensive curved wall, keep collectors above top of first floor so that occupants have south light and air. Other houses show various types either planned or under consideration. Gras and Telkes types would use salts to store heat; the others, water.

New Sun Furnaces

Using the same unit year-round can cut equipment costs, make solar houses entirely practical.

By Hartley E. Howe

SOMEDAY you may live in a home that is cooled as well as heated by a sun furnace. Engineers are convinced now that sun power can be used in place of coal or oil to heat homes. But the equipment costs so much that it isn't cheap to use this free fuel. So they're planning to combine air-conditioning and solar-heating systems to cut the cost.

In some cases the same ducts and fans might serve heating and cooling. Reservoirs for sun warmth can hold "coolth" as well. One sun-heated house has already been cooled in summer by reversing the system to take heat out of the house.

Sun-cooling may hasten the switch to solar energy. That the switch is coming—fast—many experts believe. Dean George R. Harrison of Massachusetts Institute of Technology, for example, predicts many sun-heated homes will be built in the Southwest in the next five or 10 years. The Federal Government expects a market for 13,000,000 solar-heating plants by 1975.

Two solar-heated houses built near Boston in 1949—one designed by MIT

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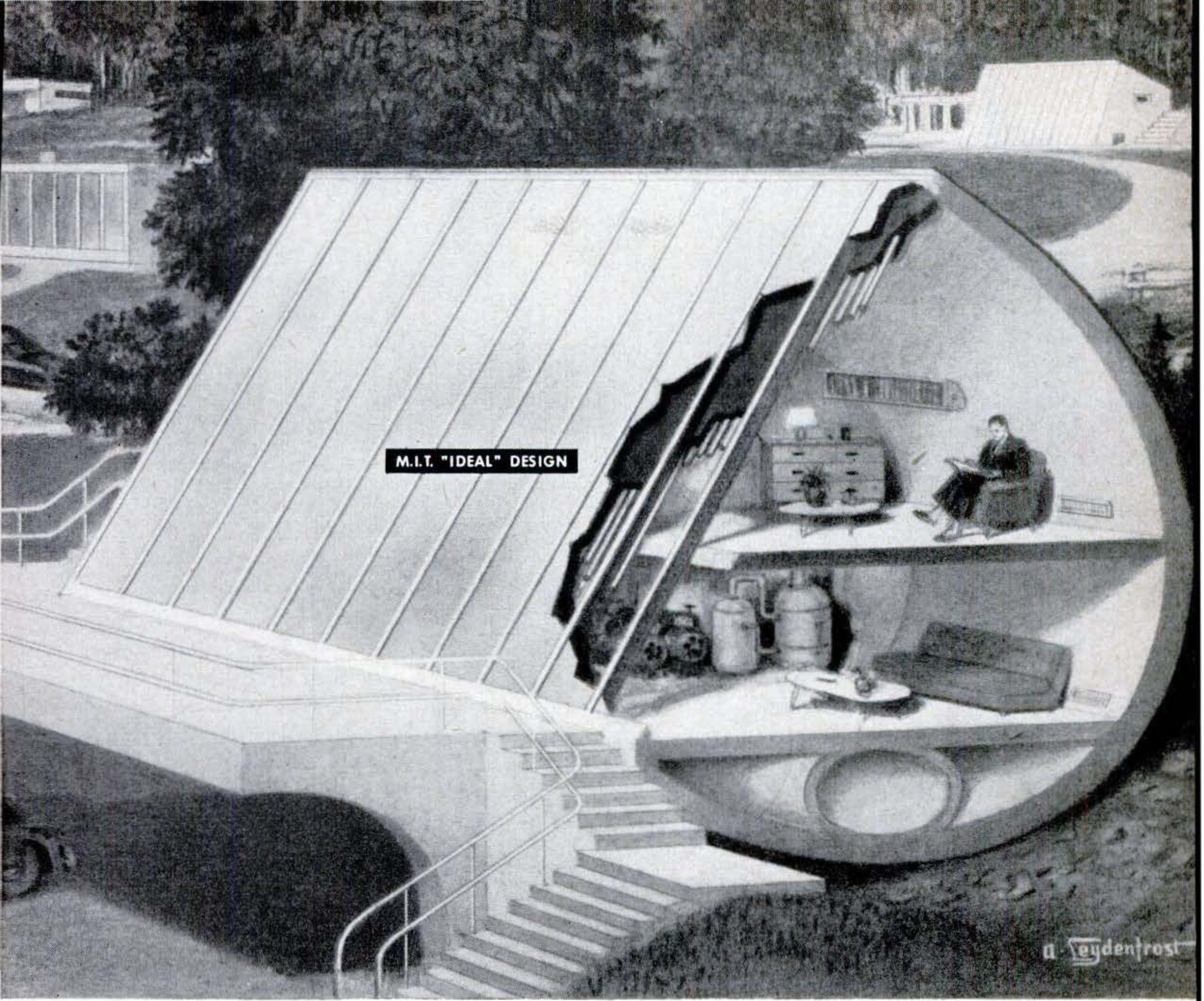

May Cool Houses, Too

experts and one by Dr. Maria Telkes of New York University—have demonstrated that sunshine *can* be successfully used for house heat as far north as New England. Now a whole new generation of sun-heated houses is planned. Four of these new houses are designed for cold northern areas.

A new MIT house should be ready for occupancy this fall. Like two earlier sun-houses designed by MIT, it will use a bank of double-paned glass collectors to heat water. But it will also have a standard oil burner.

The MIT experts are convinced that it is not economically feasible to heat a house entirely by solar energy as far north as Boston. So they will provide the auxiliary oil furnace to add heat to the water from the storage tank when it cools off on cloudy days.

The new MIT house will be designed to provide all the conveniences and eye appeal of the best of today's houses that use conventional heat. It will probably be the average three-bedroom size.

It will be built by a commercial builder for occupancy by an average family, not scientists. While Tech's experts will study its operation for the first few years, it is expected to become eventually just another home—with an unusual heating system.

The Gras house is the first house

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SUN-HEATED HOT-WATER SYSTEM is sold commercially in Florida. This "Everhot" made by Bollinger Co., Lake Worth, Fla., uses collector panels as awning over door. Tank is on roof.

PLASTIC SOLAR STILLS to make salt water fresh are being tested at Bjorksten Research Lab, Madison, Wis. Water is vaporized by sunlight, then condenses and is collected.

planned by a private individual for his own use. A young mechanical engineer, Ranulf Gras, proposes to build near Boston a much larger house than any previously planned for solar heat. With 3,000 square feet of living space, including four bedrooms, the house would be three stories high. The two upper stories would be completely covered on the south side by a vertical solar collector.

The Gras solar-heating plant is based on Dr. Telkes' system, in which air is heated in the glass collectors and circulated to bins, where the heat is absorbed by cans of special salts. A combined radiant and hot-air system will distribute the heat from the salt bins to the living areas. Air, heated by the solar energy stored in the salt cans, will be blown through ducts that run between the ceiling of one level and the floor of the story above, and then out of conventional registers in the walls.

Auxiliary heat will be supplied by commercial space-heating units, using electricity. These will operate during early morning hours when the local utility company gives a special rate. It is possible to take advantage of this saving because the heaters will be installed in the storage bins and will supply heat to the salt cans, where it will be held until needed.

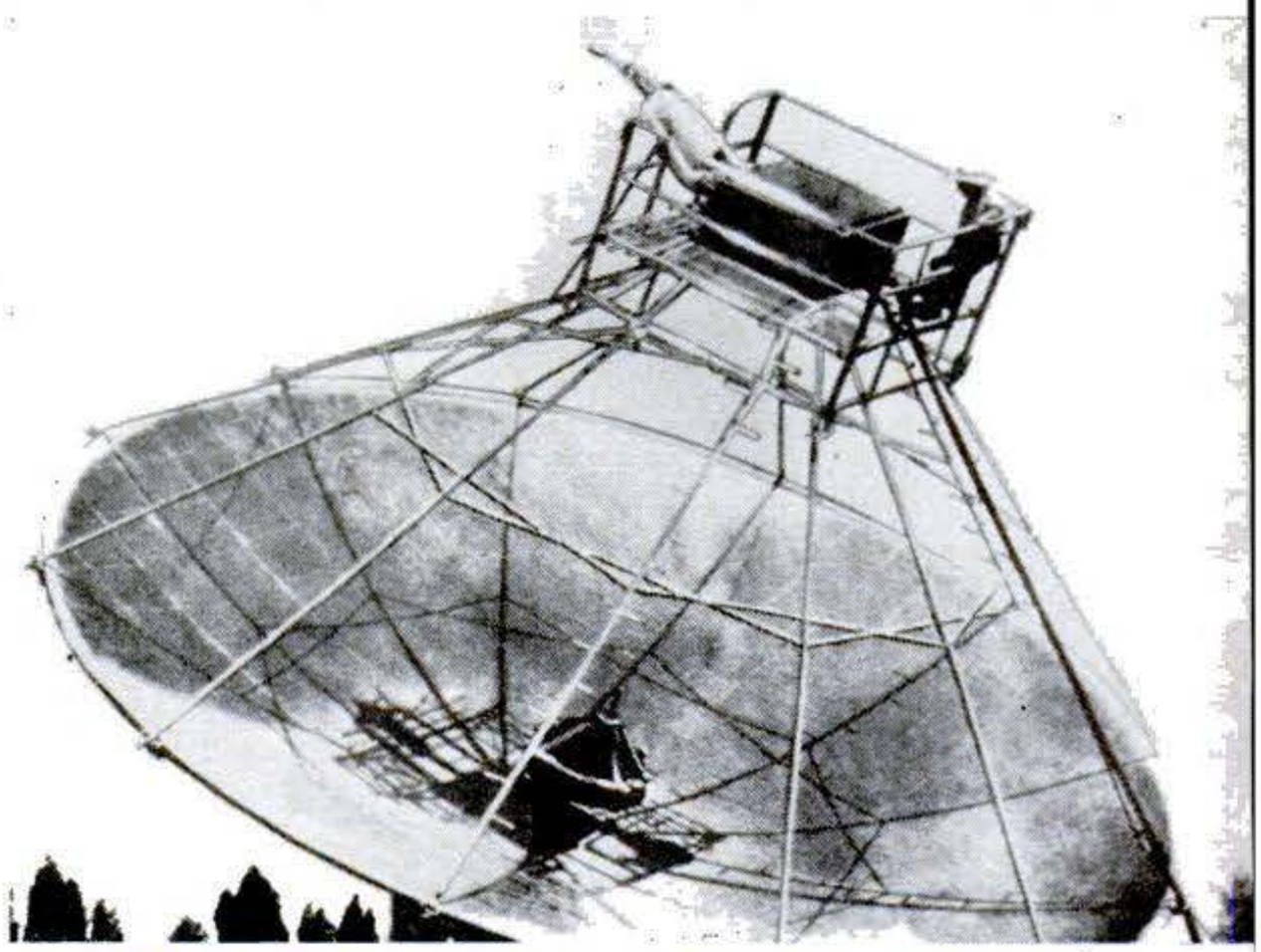
Gras plans to build the collector himself in order to save construction costs. He figures that on this basis his heating plant will cost about 50 percent more than a conventional oil furnace would.

Dr. Telkes is planning a second house, to cost $10,000 or less, depending on the area where it is built. A compact, one-story square of two bedrooms, living room and kitchen, it will be built around the salt storage bins. Heating the house will require considerably more collector area than just the south wall, so the collectors will extend on either side of the house—on one wing as a freestanding wall, on the other as one wall of the garage.

Dr. Telkes is convinced that no auxiliary heating system will be needed.

The University of Toronto sun-house,

Russians say they're harnessing



33-FOOT MIRROR concentrates sun at Russian Heliotechnical Laboratory at Tashkent. Boiler at mirror's focal point generates steam, which has been used for a cannery, heat, power.

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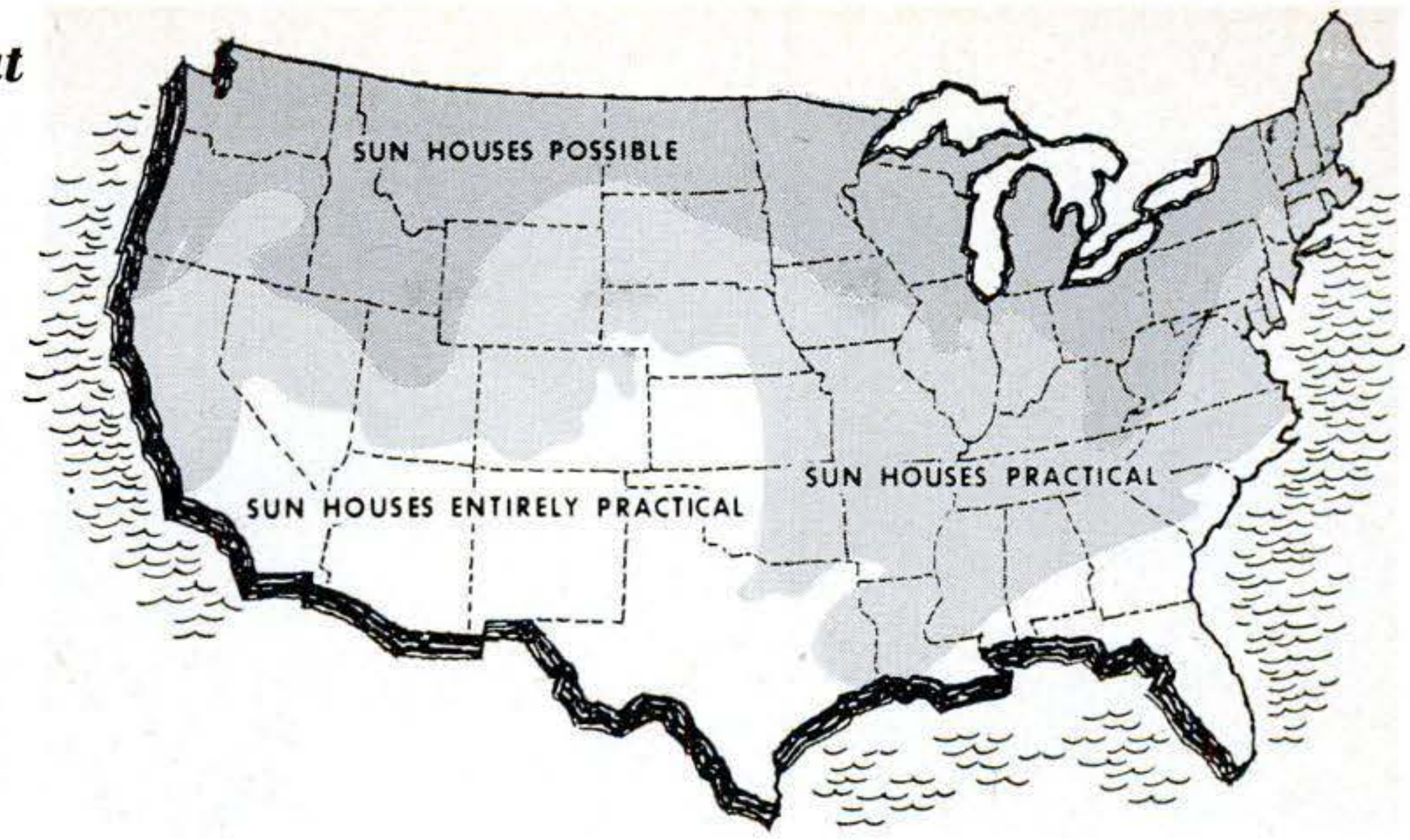
Map shows what sun heat can do



These three belts indicate solar heat efficiency in different climates, according to Paul A. Siple, U.S. Army geographer. Sun can supply all needs for entire cool season in southern belt. In middle zone, solar heat can supply all spring and fall needs but requires careful design for economy. Northern zone can use solar heat as supplementary source.

the first in Canada, will be entirely solar-heated. In order to store up enough heat to last through long spells of winter clouds, the entire basement will be a gigantic hot water tank, resembling a huge insulated swimming pool 16 feet deep.

Similar features in these proposed houses show a few general trends in the design of sun-houses.

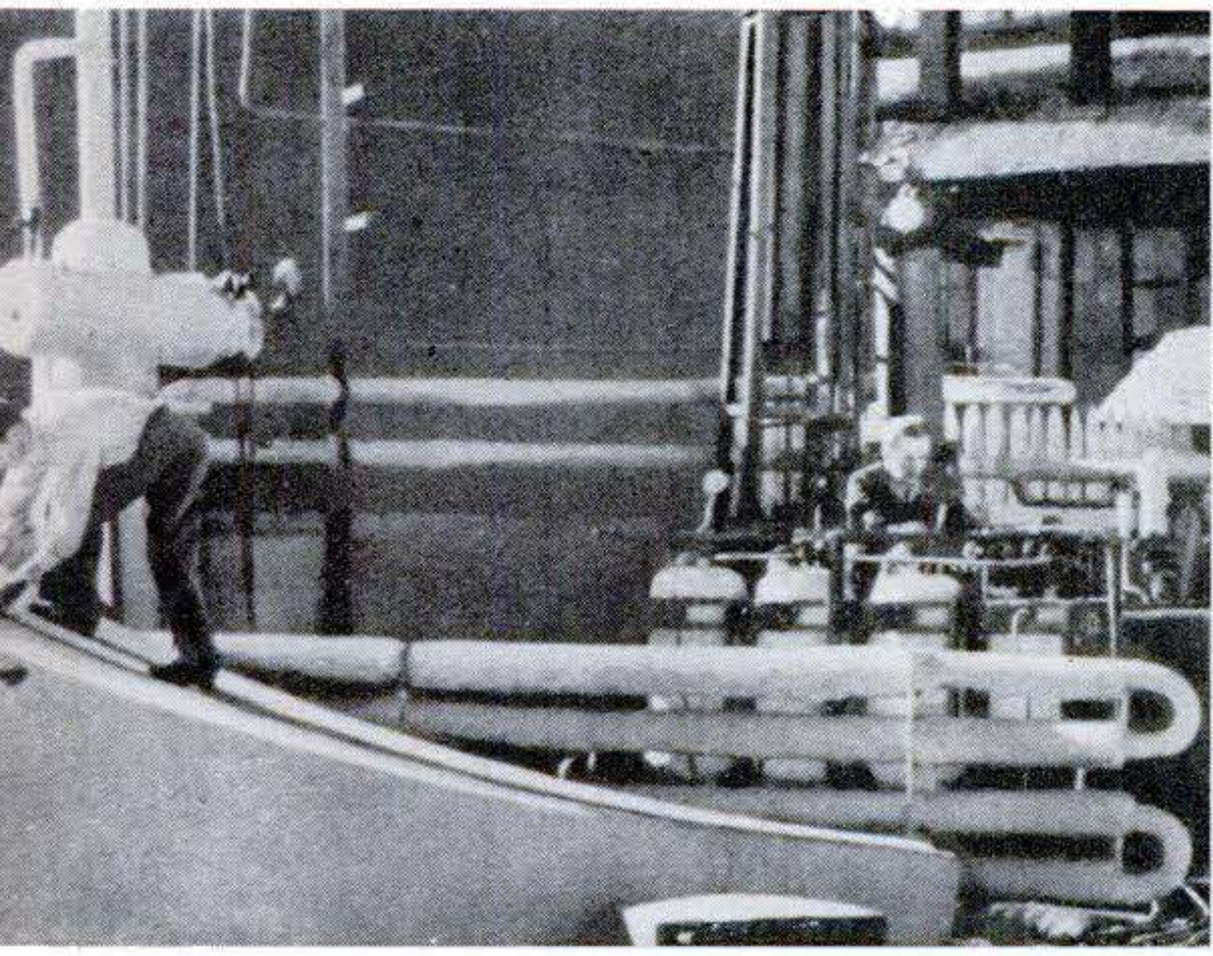
- The collector that consists of two layers of glass over blackened copper sheeting seems to be accepted as standard.
- The south wall will be largely given over to collectors, creating a problem of light and ventilation.

But the experts disagree on many points:

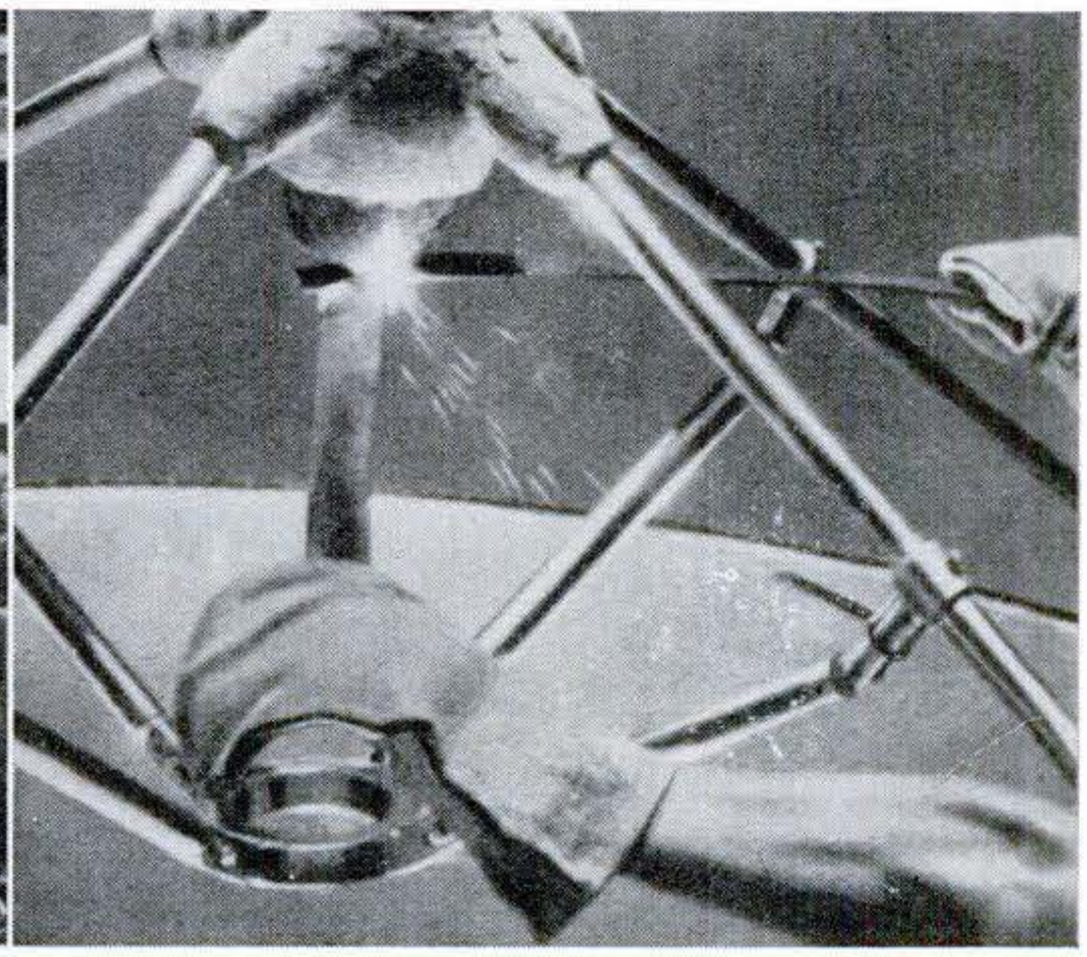
- Should the collectors be vertical, or sloped like a roof? The new MIT house, as well as its predecessors, and the Toronto house, use collectors angled to receive maximum sunlight at midwinter. The Telkes and Gras houses are designed with vertical collectors—primarily because they gain less heat in summer, so do not suffer from overheating.
- Can solar energy economically provide the entire heat of a house in northern latitudes? The answer to this question still depends on which expert you talk to.

[Continued on page 254]

the sun, too, as a free fuel for industrial processes



REFRIGERATION and water purification system is way Russians describe this photograph. The system is probably powered by steam generated by sun's rays concentrated with mirror.



"WELDING METAL through application of solar energy" is all the Russian caption says. These official Soviet pictures appeared in a Spanish-language propaganda magazine, *Soviet Union.*

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Even Airplanes Now Come as Kits

KIT airplanes, the assemble-'em-yourself kind, once again are being made for the private pilot. The idea has the blessing of the Civil Aeronautics Administration.

The kit consists of wing-structure materials, tail and fuselage. It comes in a crate weighing about 500 pounds, and is available as either a one- or two-passenger plane.

The manufacturer, Ray Stits of Riverside, Calif., sells his package for a one-seater at $995 F.O.B., and for a two-seater at $1,295.

Beefed-Up Wagon Tows Trailer

AN $8,000 station wagon tows the trailer of A. W. Kammerer, Bakersfield, Calif. The lengthened chassis, heavily beefed up, rolls on truck tires. There's a truck engine under the hood. With a winch forward and two generators aboard, it can go anywhere.

Depth Sounder Finds Fish

THIS fisherman is using a small electronic depth sounder to hunt out the deep spots where the big ones hide. It costs $1,185. Raytheon of Waltham, Mass., expects the Fathometer to be used by resort owners and other groups interested in charting waters.

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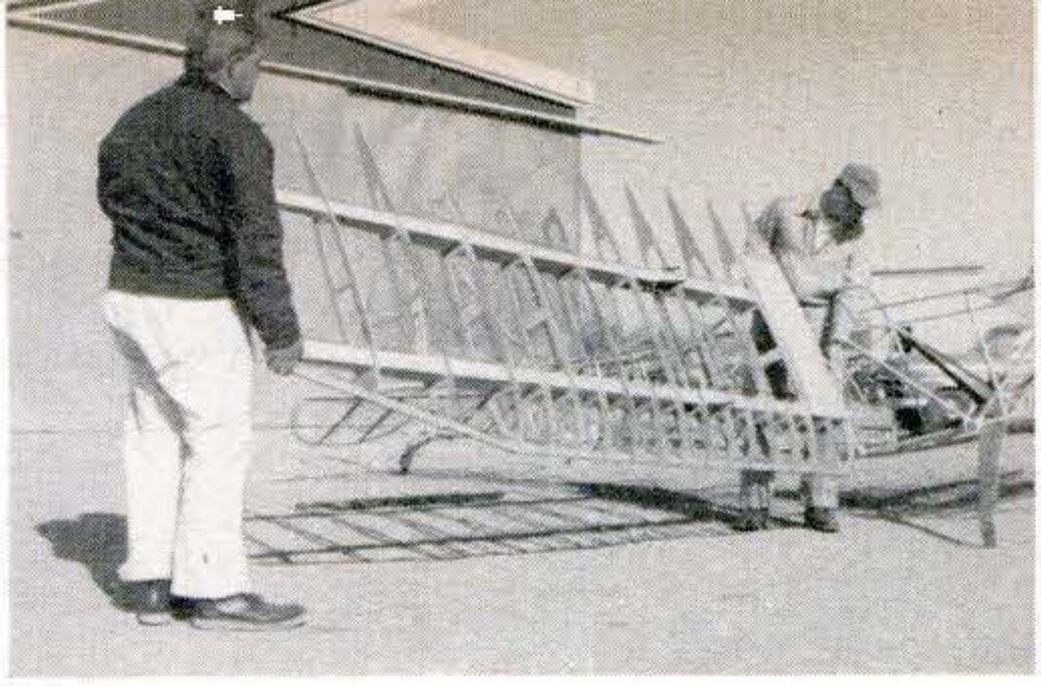
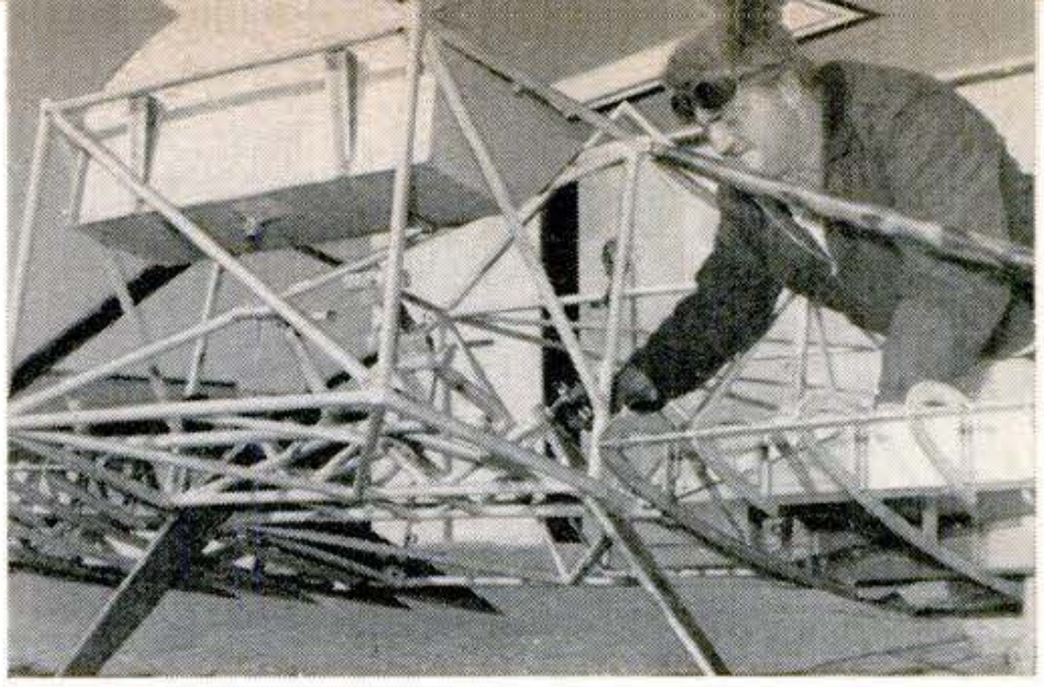
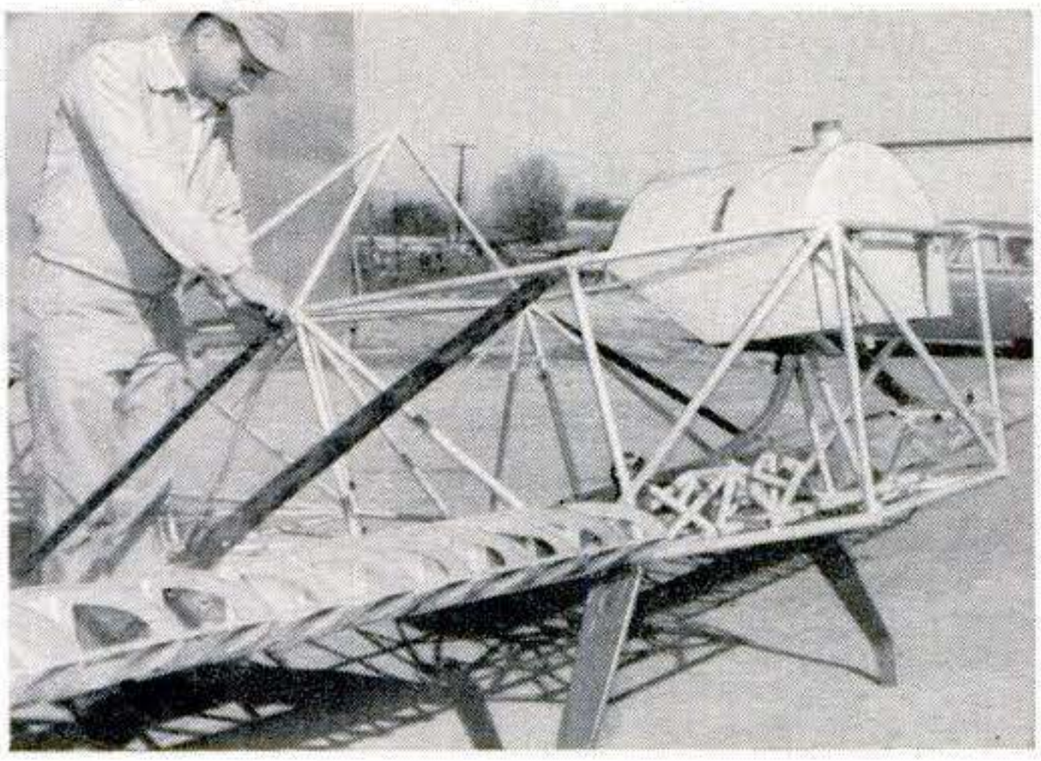


SKELETON WING shows its plywood ribs as builders jockey it into place for mounting.

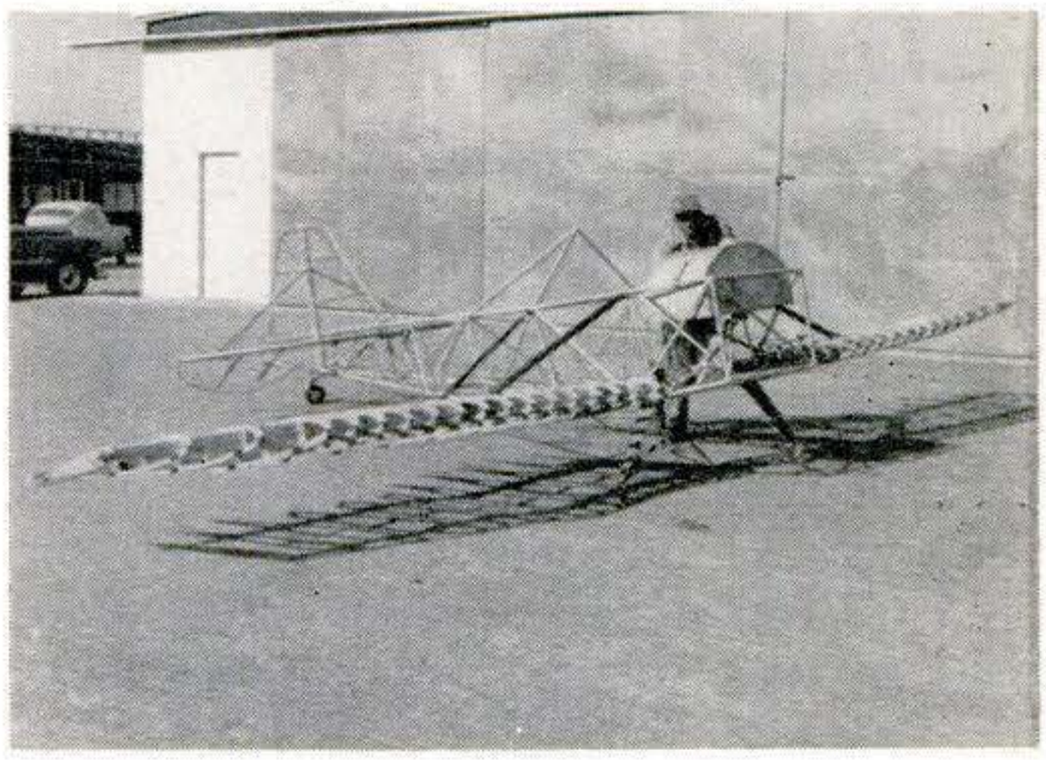


GAS TANK and cut-down Cessna landing gear are among 40 pieces that come with kit.

WING STRUTS, bolted to fuselage of welded tubing, support wings spanning 23 feet.

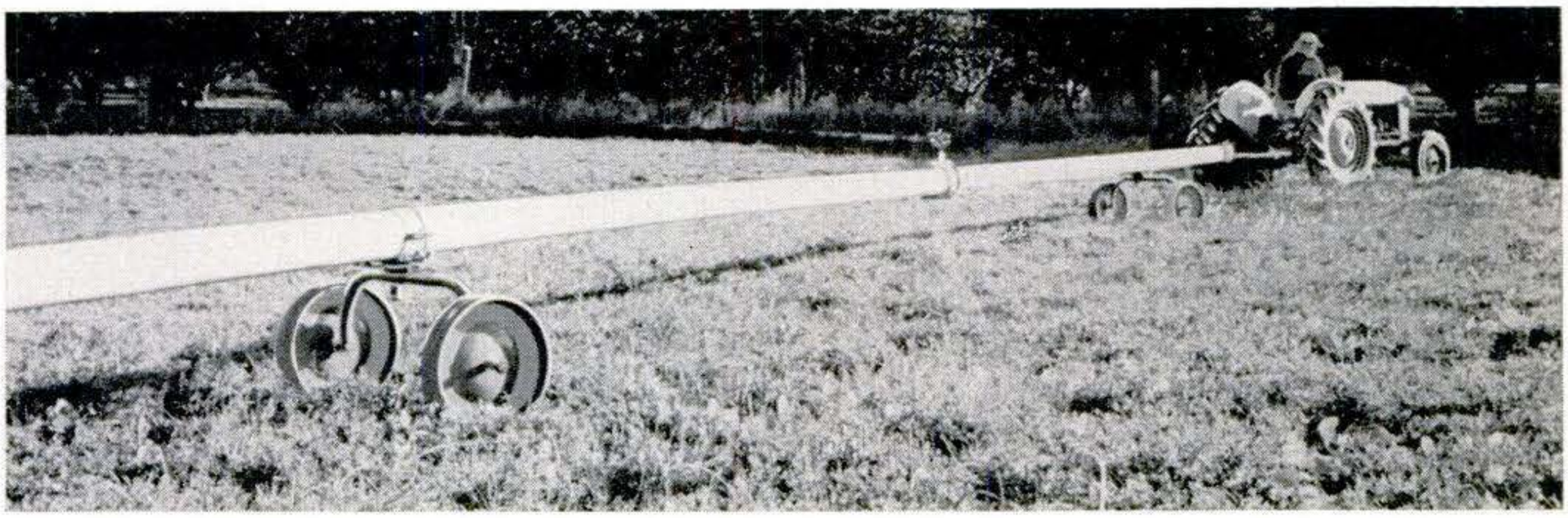


TWO-SEATER shapes up. With skin on its bones and 135 horsepower for muscle, it'll hit 150.



His package does *not* contain fabric for the wings, tail or fuselage; engine, propeller, wheels or tires, brakes, instruments, cowling, tail wheel and miscellaneous items such as safety belts. These parts, says Stits, can be picked up secondhand at a fraction of the new cost.

No Government license is needed to build a kit plane, off the market since World War II. The CAA's interest in kit planes stems from its alarm over a "continuous reduction" in the number of student pilots, flight instructors and aviation mechanics in the United States.



Swivel Wheels Let Farmer Roll Sprinkler Line Across Field

WITH these tricky wheels, a farmer can shift a quarter-mile of irrigation pipe in minutes—without driving his tractor through crops. Operating at the edge of a field, he attaches one end of the wheel-mounted pipeline to the tractor. Then, as he drives off at a 45-degree angle, the wheels pivot like casters, and the pipe rolls laterally across the field. Built-in "stops" limit the pivot to keep the line straight. R. M. Wade & Co., Portland, Ore., maker of the device, calls it the Power-Shift.

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'Fingerprinting' Molecules Now Helps Trap Criminals

A new machine, using infrared light, tells the cops what car a tiny paint speck came from.

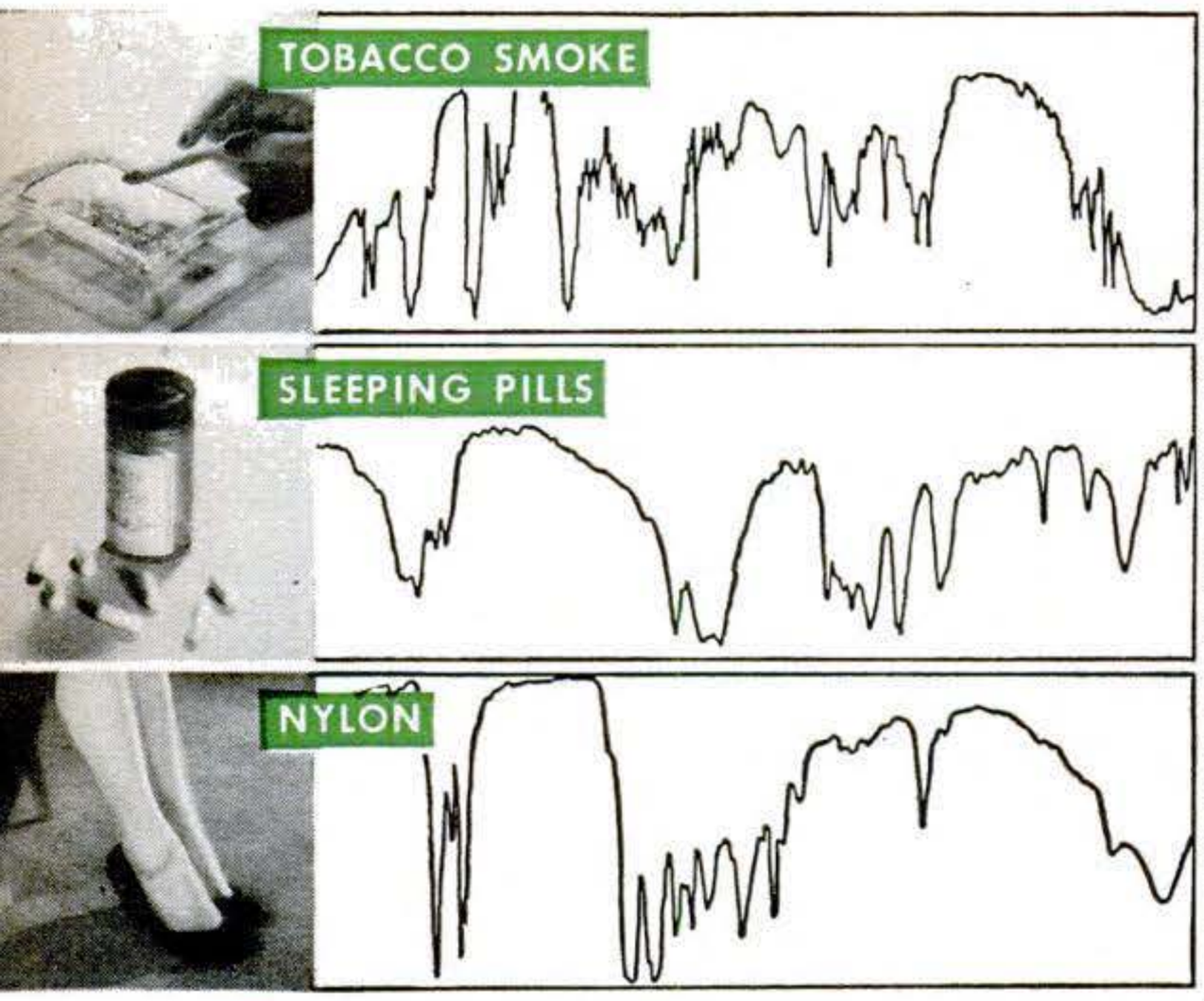
By Harland Manchester

AFTER a bank robbery in Louisville, Ky., last year, police found a homemade pistol in the getaway car. Its grip was painted red. In the room of one of the suspects, police found a brush smeared with red paint. They sent gun and brush to the laboratory of the Federal Bureau of Investigation in Washington.

There a sample of paint from the gun grip and another from the brush were scrutinized by a revolutionary new device, the infrared spectrometer. Having analyzed the samples and identified their ingredients, the machine established that the two were identical. The robbers were convicted.

This is only one of thousands of delicate jobs that the infrared spectrometer has performed since its commercial introduction some 10 years ago. In hospitals, scientific laboratories, refineries, chemical plants, and in food, drug and cosmetic industries, this fast and accurate new identification device has pushed back research frontiers, protected consumers against fraud and saved many millions for manufacturers.

A railroad signal wire was cut in a Southern town and a train was nearly wrecked. A man with a grievance against the railroad was suspected. In his barn police found an ax bearing a tiny red streak that looked like the red plastic insulation on the severed wire. The red streak—so small that it would have been



"FINGERPRINTS" OF MOLECULES come out of machine as charts like those above. Graph tells how much infrared light at different wave lengths sample absorbed, indicating its composition.

FBI LAB (above) is one of many police groups that use Perkin-Elmer infrared spectrometers to identify clues. Auto companies also use them to study efficiency of fuel burning in engines.

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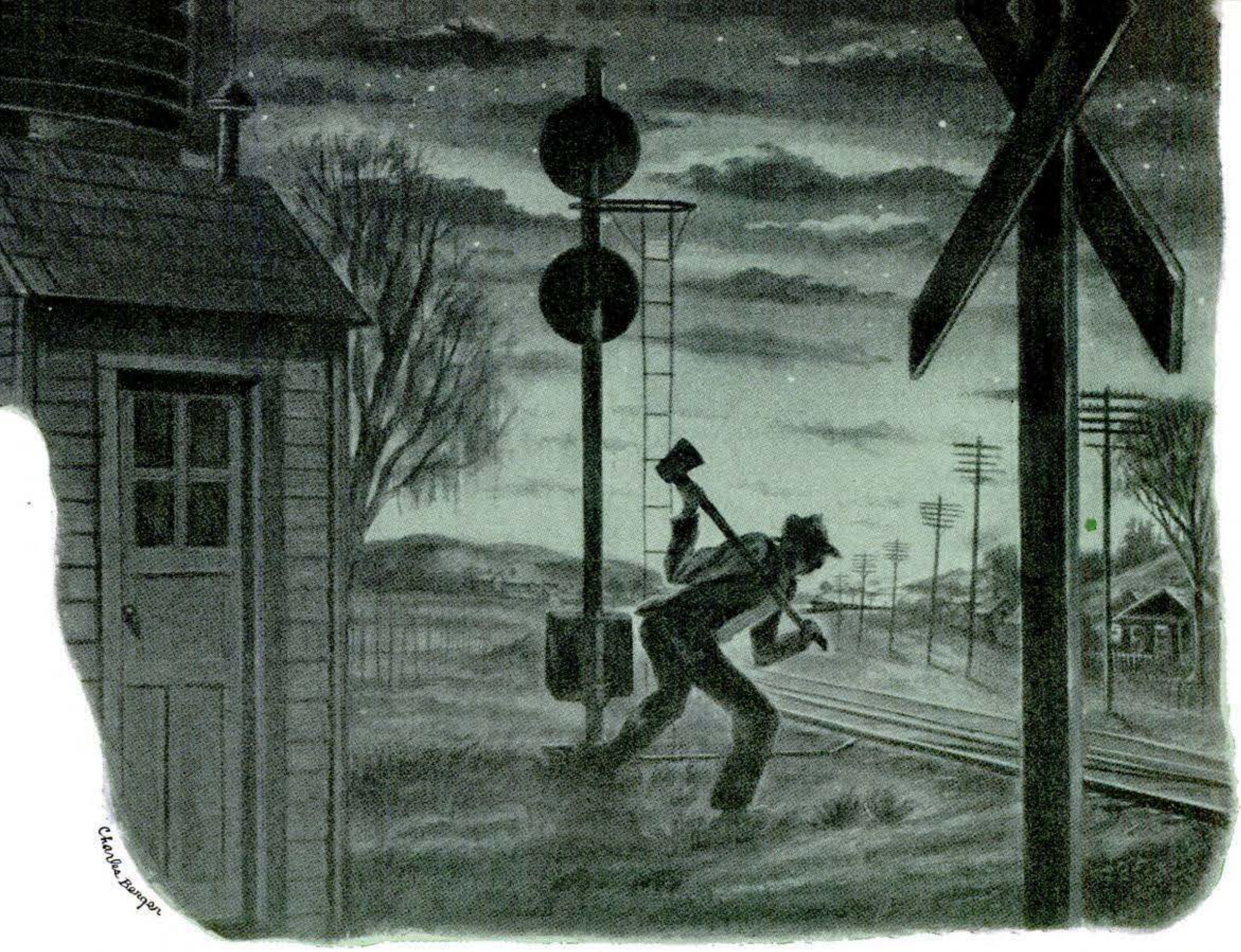

Speck on ax gave "fingerprints" that put finger on man suspected of trying to wreck train.

next to impossible to analyze by any other method—was "fingerprinted" by the infrared machine and proved to have the same distinctive molecular structure as the insulation.

The spectrometer has also helped to exonerate suspects. When a man was found murdered near a Virginia garage with car grease on his clothes, the garageman was held. But when the machine drew the pattern of the grease and compared it with that used in the garage, they did not match; the man went free.

In other instances, wax found in a man's knife checked with the wax on a dynamite fuse in an explosion case; in a rape case a scrap of plastic found on the scene proved to be identical with the plastic hat lining of a suspect. Ingredients of stench bombs have been traced to their source; poison used by a boardinghouse mistress in a pie was identified.

What is the principle behind this ingenious device, and how does it work? Its first crude prototype was built by the English astronomer, Sir William Herschel, in 1800. He placed a prism in a beam of sunlight, broke the light into all colors of the spectrum, and measured their temperatures with thermometers. He found that the red light at one end of the spectrum was warmer than the violet light at the other end. Then he found that when he placed the thermometer a little beyond the red end of the spectrum, outside the visible area, the mercury went still higher. He thought he had discovered a new kind of energy.

Experiments of the next century showed that he was wrong: Herschel's invisible infrared heat ray was not a new kind of energy but only one of many kinds of similar radiation, such as visible light rays, X rays, ultraviolet rays, radio and radar waves, all of which have different effects because of their different wave lengths.

Today's instrument owes its origin largely to W. W. Coblentz, who in 1903 as a graduate student at Cornell began

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to study the use of infrared rays in analyzing chemical compounds. To understand its principle, remember why objects have color: When sunlight falls on a yellow apple, other colors are absorbed and yellow is reflected.

Coblentz got similar results when he bombarded his chemical samples with infrared rays of various wave lengths. Each compound absorbed certain wave lengths, while infrared of other wave lengths passed through unchanged. By measuring the rays that passed through, Coblentz could get a significant picture of the wave lengths that were absorbed, or blocked. No two compounds have the same absorption patterns, just as no two men have the same fingerprints. This was exciting, for here was a way of fingerprinting chemicals for later identification.

In today's spectrometer, a bench-mounted device about three feet long, the absorption pattern of the chemical to be analyzed is translated into motion so that a stylus "draws a picture" of the compound on graph paper attached to a slowly rotating drum. These graphs, which superficially resemble stock-market charts, are so characteristic that a skilled technician can spot at a glance such common substances as nylon, aspirin or tobacco smoke.

There are, of course, other methods of chemical analysis, but the infrared spectrometer has the great advantage of speed, and can often furnish the missing link in a crime from a scrap of material too tiny to be identified in any other way. A mere speck of fuzz from a synthetic fabric can be burned and the machine will scan the vapor and tell in a few minutes what kind of garment to look for in the suspect's wardrobe.

It is especially accurate in reporting the composition of paints. Different automobile makers use different kinds of finishes. When detectives are investigating a hit-and-run case, they often find a trace of paint on the car or pedestrian that was struck.

Even if the offending car has been repainted, a bit of the original paint job often adheres to the sample.

Sometimes it is possible, by making an infrared analysis of a small fleck of paint, to say to local police: "Look for a green car, made by X company, that was originally gray." That narrows down the search.

Among materials easily fingerprinted are cellophane, friction tape, rubber heels, adhesive plaster used to tie up victims, wax crayon on extortion notes, chewing gum, glue, face powder, lipstick, inks and dyes. The FBI has a library of graphs of all these common materials in their several varieties.

Three infrared spectrometers in the laboratories of the U. S. Food and Drug Administration have greatly speeded up the work of protecting the public against frauds and dangerous ingredients in foods, medicines and cosmetics. About five years ago many women throughout the country reported that their fingernails were loosening and falling off. Infrared analysis showed that a certain new undercoating widely sold to make nail lacquer adhere better was doing the damage. The product was withdrawn from the market.

More recently, the infrared pattern of

[Continued on page 256]

WITH only five minutes to get to the station, Dad dashed out to the car. But pressure on the starter button brought only a sickening click as the relay closed. He tried the horn; it blew. The lights glowed full strength. Dad lifted the hood, took a quick look at the battery and then ran back into the house to get a hammer.

...How Come?

ANSWER: *Though the connections were all hooked up, Dad noticed that one battery cable was loose on its terminal. This loose connection carried the voltage for the horn and lights, but the resistance was just too much for the high pull of the starter motor. A few light hammer blows drove the cable snug on its tapered terminal.*

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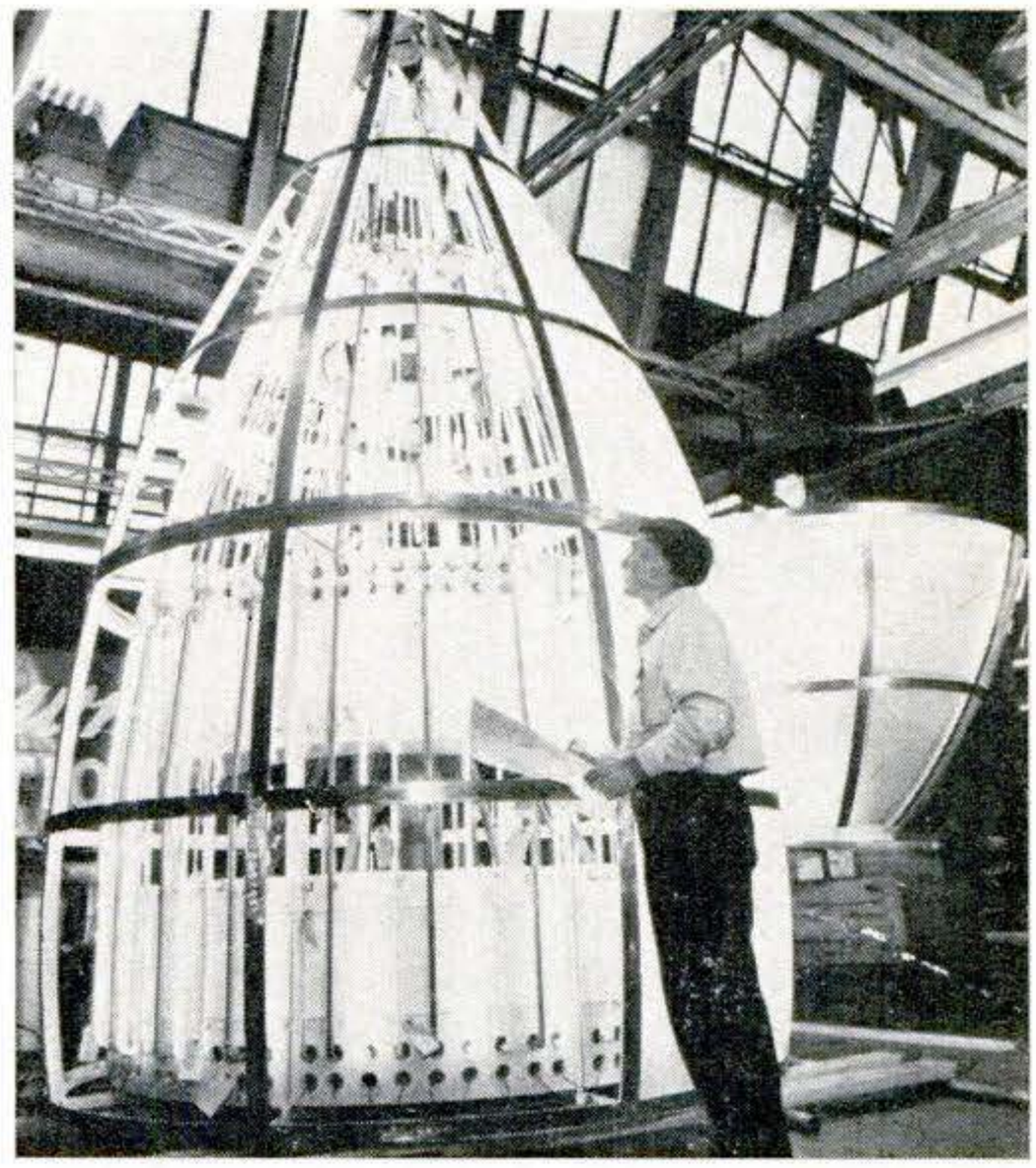
Kiddie Copter Has Bucket Seat for Sidewalk Whirlybirdster

ALTHOUGH it is equipped with a rotor and rudder, the pilot of this helicopter must use his imagination to get off the ground. Pedals drive the two front wheels and the steering wheel turns the back one—and the tail. Charles William Doepke Mfg. Co., Rossmoyne, Ohio, makes the toy flying machine, calls it the Rolybird.

Join the Navy—and Be a Nurse

A HUSKY sailor shows off a newborn baby. No, it's not his. It's just part of his job at the Naval Medical Center, Bethesda, Md., where medical corpsmen are helping out during a nurse shortage. Soldiers also are being trained as nurse's aids.



Neon Sign to Forecast Weather

WHEN covered with plastic, this stainless-steel framework will look like a giant gas flame. Different-colored neon lights inside the 21-foot-high structure will predict rain or shine from atop the El Paso Natural Gas Co. building, El Paso, Tex.

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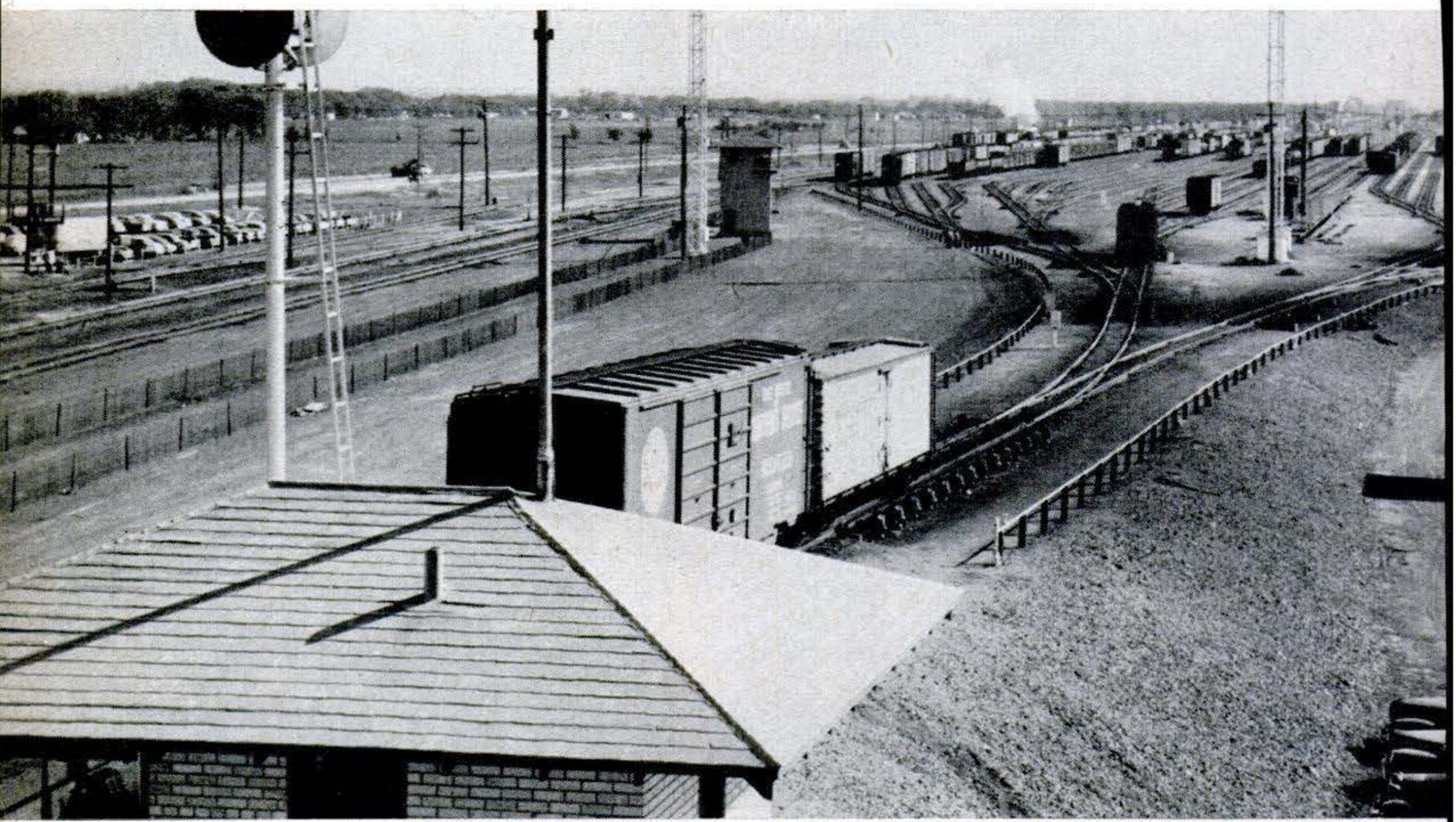
Pinball Machine Runs



Robots flip the switches and put on the brakes as cars roll down the hump in this Union Pacific freight-shuffling maze.

By Kenneth Wylie

CLACKING eastward down the main line to the hump yard at North Platte, Neb., Union Pacific freight trains still surge, as always, under the control of an engineer's steely grip and hawk eye. But at the yard there's a change now. A pinball machine takes over.

It is part of an Electronic Yardmaster that steers cars through the classification yard and brakes them as they holler down the hump to form new trains.

Eight of North Platte's 42 fanning tracks are controlled by this new device now. Soon it will be Yardmaster across the board.

Already the new Yardmaster is saving the Union Pacific money. Last year the nation's rail lines paid out $111,400,000 because of damaged freight. A lot of that damage was caused by coupling collisions. At North Platte such losses have been cut more than 75 percent by the new Yardmaster.

The North Platte Yardmaster isn't the first automatic rail-yard control system, but it's probably the simplest. It has a guided-missile tracker-computer to work the hump-yard wheel retarders and a series of falling balls to switch the cars.

"We could have made a fancy, complicated setup, but our way is more sensible for this job," says Roland J. Berti, conceiver and co-builder of the prototype

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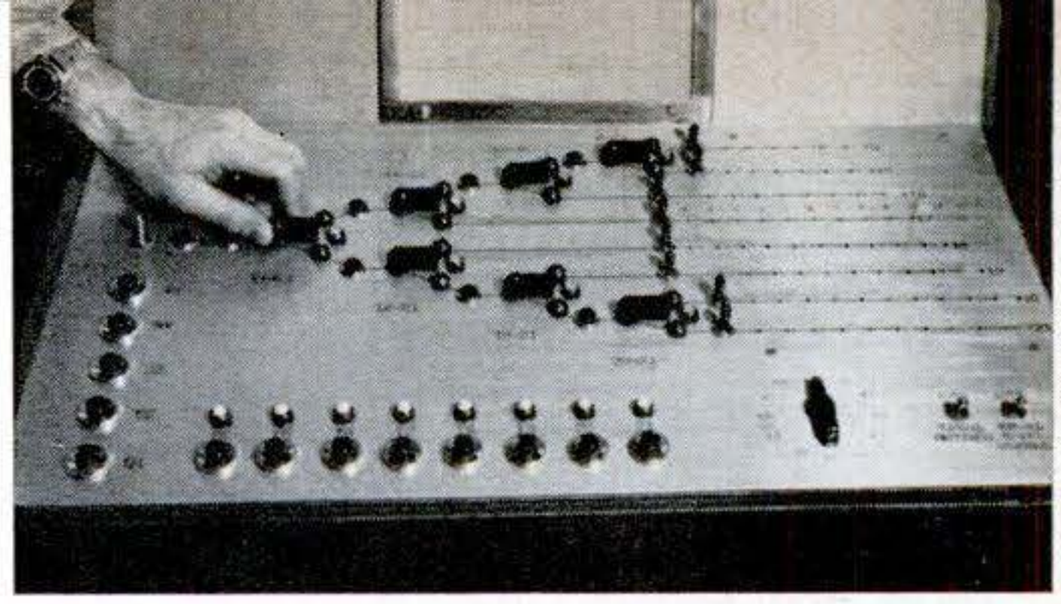
Rail Yard



CONTROL BOARD in tower is laid out like section of yard it operates. Track-selector buttons across bottom correspond to eight controlled tracks. The triangular bank of handles and lights shows actual switch operations. The buttons along the left side of the board allow the operator to cancel and change signals.

pinball machine. "Why drive a Cadillac to get groceries?"

Freight railroading would be as simple as hauling groceries home if, for example, you could load TV sets and frozen meat pies in Chicago and send them highballing down one long track to Los Angeles. But you can't run a railroad by stringing only the biggest cities together. You have to chop the trains apart at junction points and reroute cars to smaller towns.

This is North Platte's job.

Such wide places in the track, where trains are reshuffled, are called classification yards. The newest breed of them is the retarder yard or hump yard, named for the long hill that substitutes gravity, in moving the cars, for switch engines.

Until recently a towermaster or operator sitting at a manual control panel atop a 30-foot tower had to switch each

PINBALL MACHINE, on floor below, is a stack of conduits through which steel and glass balls clatter down from level to level. Their effect—or lack of effect—on tuned audio-frequency coils at each level triggers the signals that flip the switches to the left or right.

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TOWERMASTER code-punches routing orders for freight cars into console that controls switches in classification yard and starts computer that retards them as they roll down the hump.

car, retard each car, read a teletype order list, and take added instructions over an intercom—all at once.

So the U.P. decided to turn the operation over to a robot greasy grind that would bury its head in the relay banks and ignore distractions.

The heart of the finished automaton is in a compartment hung halfway up in the base of control tower B, one of North Platte's five control points. There, under the calm dominion of Union Pacific equipment man, Ervin Huebner, the pinball machine clicks through problems as its electronic colleagues huddle close by.

The switching machine stands about as high as a good basketball center and consists simply of a channel-iron frame hung with motors, ball conduit, rotor valves, switches, and hoppers. Their configuration reminds you of a real pinball machine.

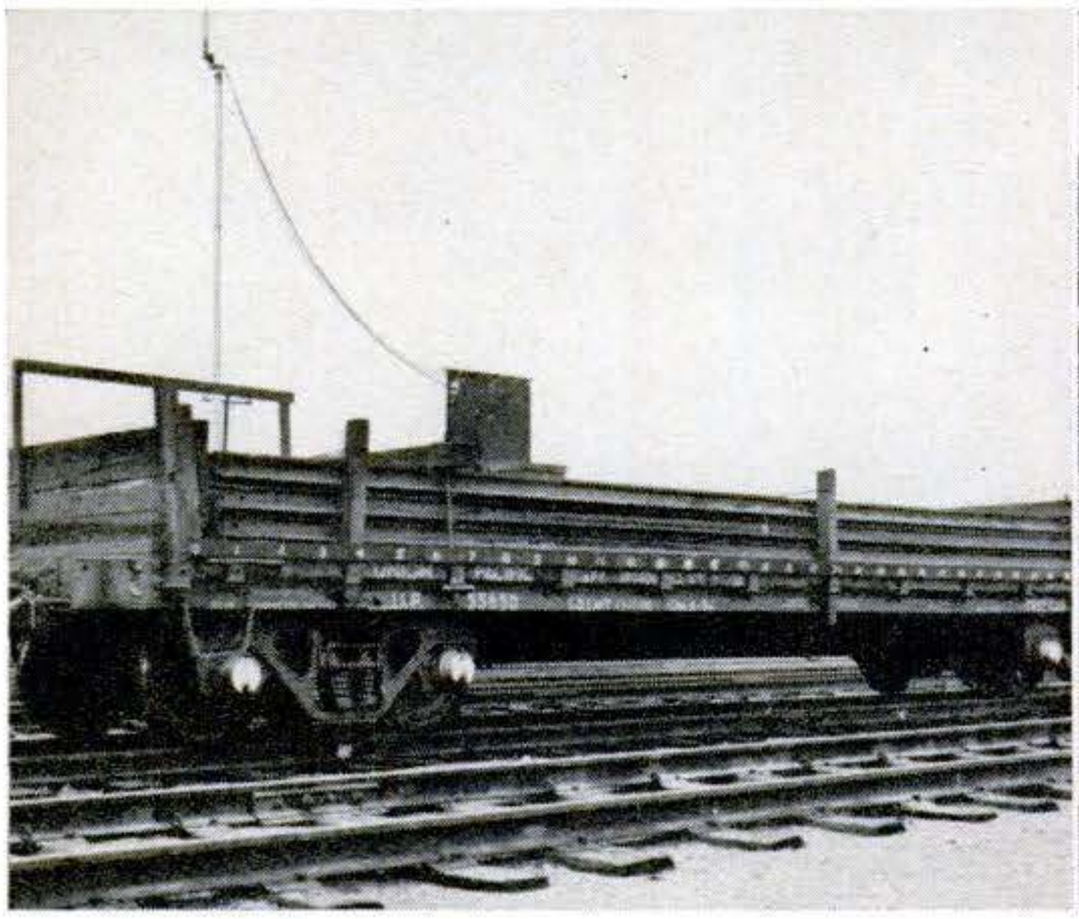
Steel and glass balls fall from storage along paths from obstacle to obstacle. At these obstacles, which are really rotor valves, the arrangement of the balls is detected by audio-frequency sensing coils, and a charge is flashed to track switches, tripping them right or left.

Steel balls increase the inductance of these coils and throw them out of resonance. This moves switches left. Glass balls don't faze the coils. They throw switches right.

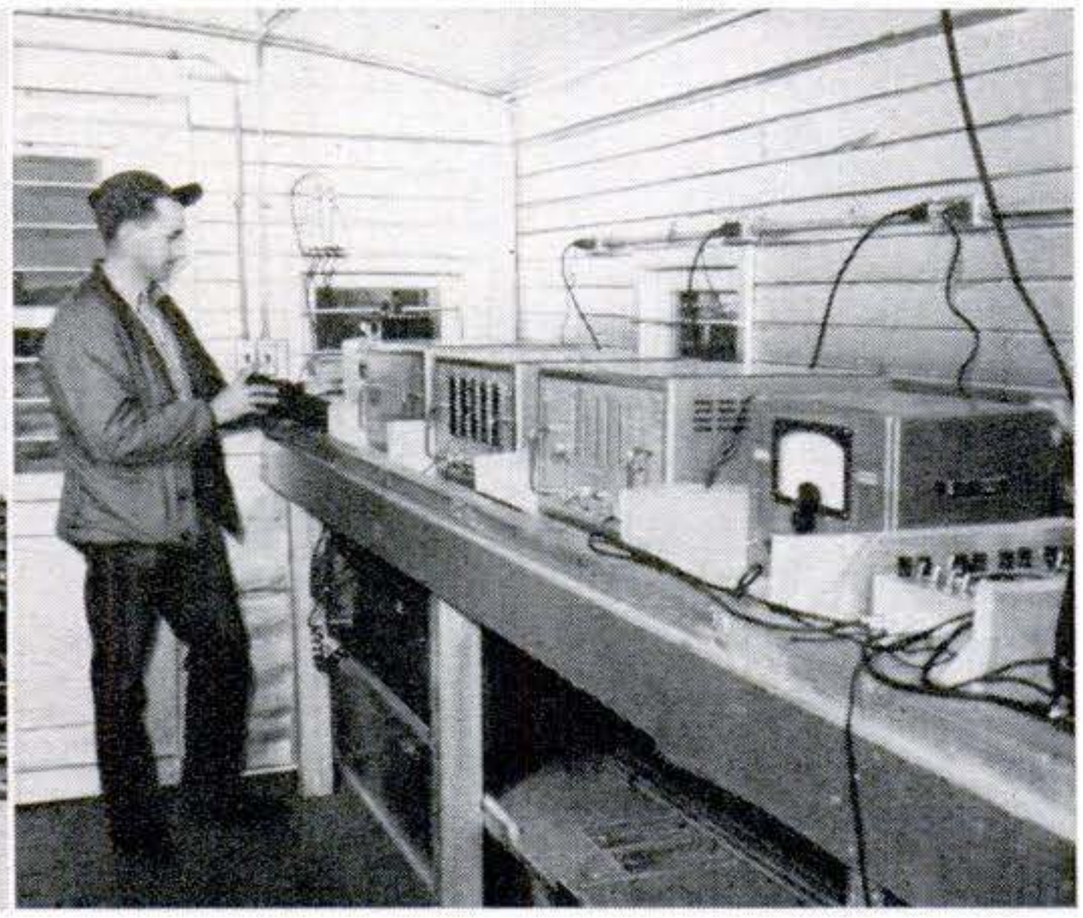
Each car passing through the Yardmaster's control is represented in the pinball machine by five balls: a steel pilot ball and a switch code of four balls. The code balls may be all steel, all glass, or a mixture.

Across the cell from the pinball machine is the retarder-control phase of the Yardmaster. It is a modified Reeves Electronic Analogue Computer, originally designed and built by Reeves Instrument Corp. for guided-missile control and altered to suit Union Pacific's needs.

On the floor immediately above the pinball-computer room, the towermaster of tower B sits. The manual retarder console, as big as a drafting table, is in front of him; the pocket-sized Yard-



TO MAP YARD for electronic car shuffling, engineers put pulse generator and transmitter on this test car. Rolling down track, it broadcasts beeps in time with its speed.



IN SPECIAL CABOOSE receivers monitor beeps from test car and record "rolling characteristics" of each track for use in memory circuits of retarder pictured on facing page.

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master console, to his left. The big board controls tracks 1 to 13; the Yardmaster, 14 to 21.

When a switcher backs a newly arrived train up to the hump crest from the receiving yard, the operator in tower B sets up the Yardmaster console by pushing track-selector buttons for each track he wants to put a car on.

Classification begins as the switchman up on the hump cuts cars loose singly and in groups to roll down the far slope to designated tracks. At this same time the automatic speed-control phase of the Yardmaster comes into play.

The REAC computer plots a car's acceleration rate by timing it through three track circuit switches at the beginning, middle, and end of two butted 39-foot test tracks on the hump.

By subtracting the acceleration caused by this known slope from the car's total acceleration, the computer gets the net acceleration. This is that part of the total speed gain accounted for by wind and friction acting on the car.

Instantly the analogue takes this figure and includes it in an equation with figures for the distance to coupling point, height of track slope, acceleration due to gravity, and desired coupling speed.

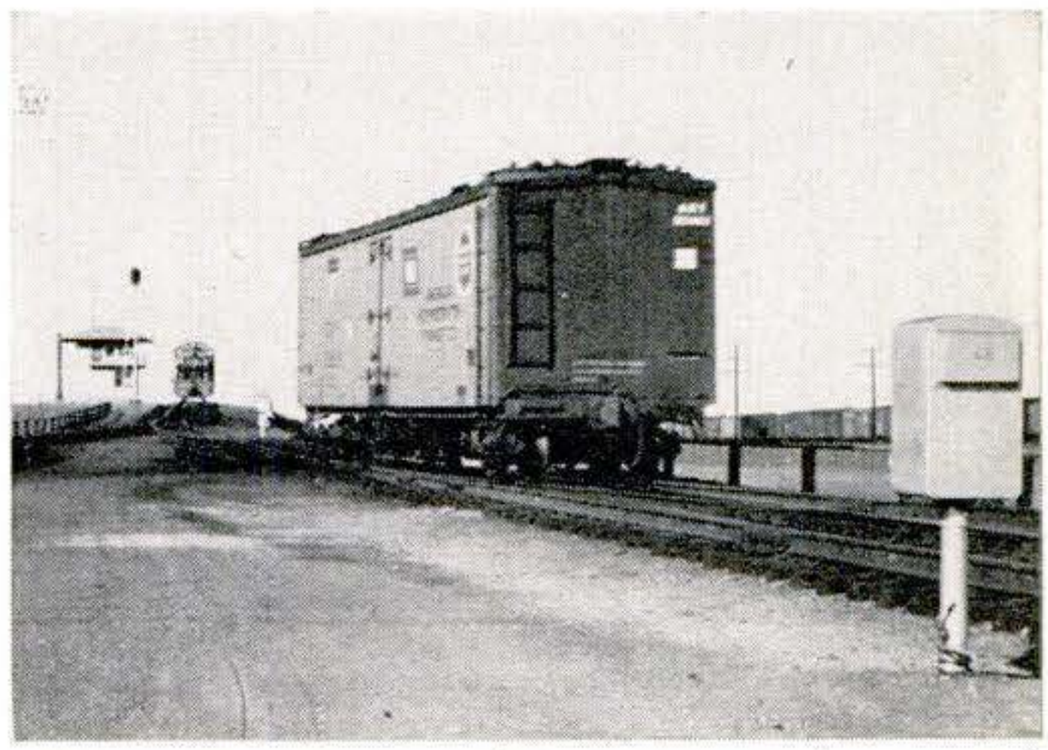
Whipping through this equation and combining it with stored data on the rolling characteristics of the particular track the car is going to, the Yardmaster computer shoots its answer, in DC current, down to the retarder controller.

Simultaneously, the Yardmaster runs an on-the-spot check on the car's speed. A radar speed meter, the kind that trips drivers on the highways, clocks the cars going through the retarder and shoots its own dose of DC to the controller.

These two jabs of voltage, proportional to calculated speed and to measured speed, mix in the retarder controller, trigger its three-way pneumatic valve, and clamp long brake bars against the passing car wheels. If the computer and radar meter have done their jobs well, the car will roll its full course, perhaps three quarters of a mile, and couple at a gentle two m.p.h. END

HOW RETARDER WORKS: These memory circuits in electronic computer are pre-packed with data on the rolling characteristics of eight tracks controlled by automatic Yardmaster.

RADAR SPEED METER clocks car as it rolls by and flashes its report to computer. Computer then figures how much car should be slowed to achieve desired speed at end of its run.



BRAKES ARE APPLIED by a pneumatic-powered retarder mechanism that squeezes soft-iron bars against the passing car wheels. Computer tells retarder how much squeeze to apply.

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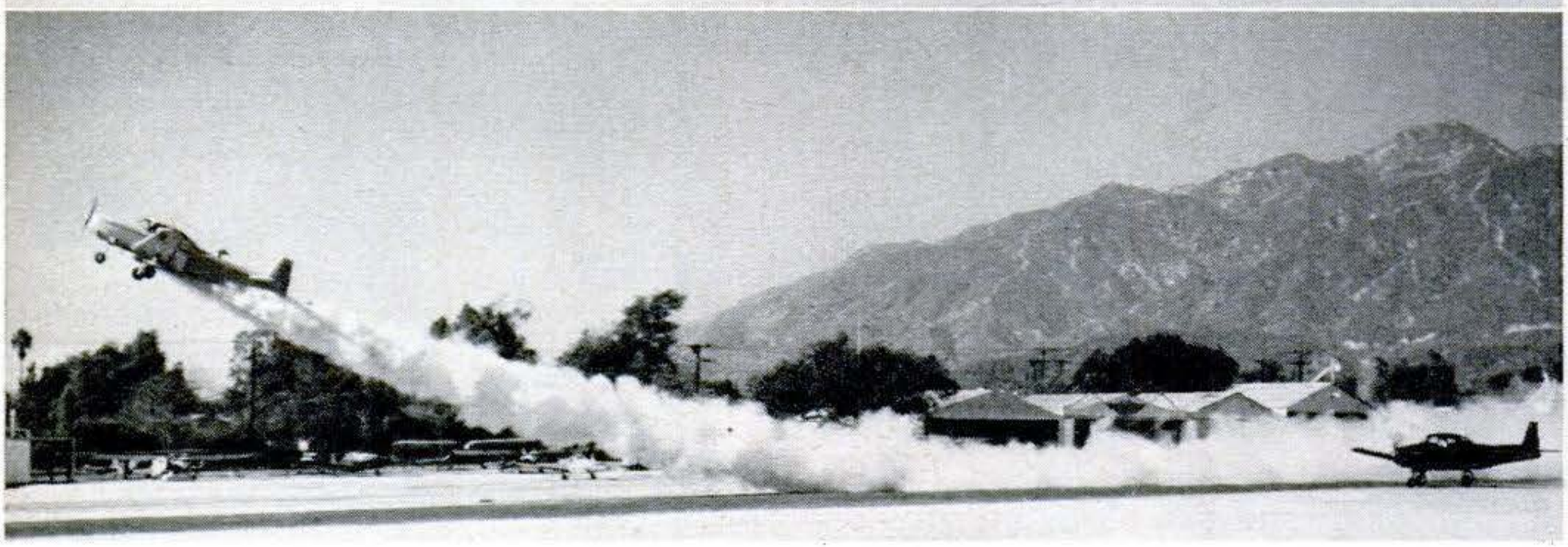

TWO RYAN NAVION LIGHT PLANES are shown in top photo starting their ground rolls at the same time. The one at left fires a JATO Junior. Lower photo shows it well in the air and climbing at a sharp 40-degree angle while the other plane is still on the ground.

Boosters Kick Off Civilian Planes

SINCE planes need a longer-than-normal ground roll when taking off from airports at high altitudes or in very hot weather, they often have to sacrifice some of their payload of passengers or cargo. Now, with jet-assisted take-off, recently made available for civilian use, commercial airliners can get off the ground fast and in a steep climb, just like their military brothers.

Newest of these power boosters is a junior-size JATO for light planes, enabling them to take off from very short fields and to hop quickly over airport obstacles such as trees and power lines.

Using bigger Aerojet-General units, an airliner was able to get off from La Paz, Bolivia, where the airfield is 13,400 feet above sea level, with 29 instead of nine passengers.

Ethiopian Air Lines uses JATO in flights from high-altitude airports such as Addis Ababa.

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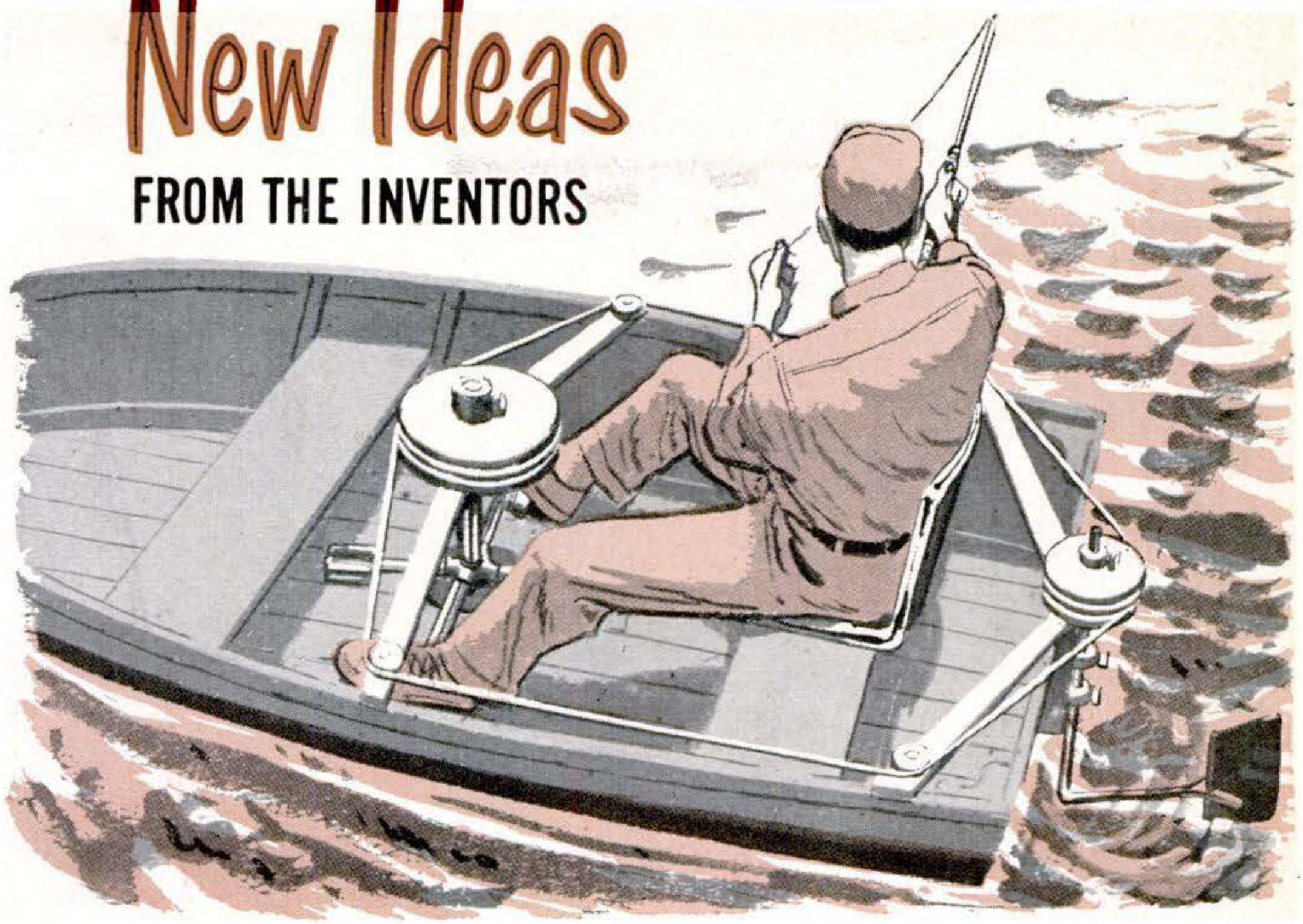
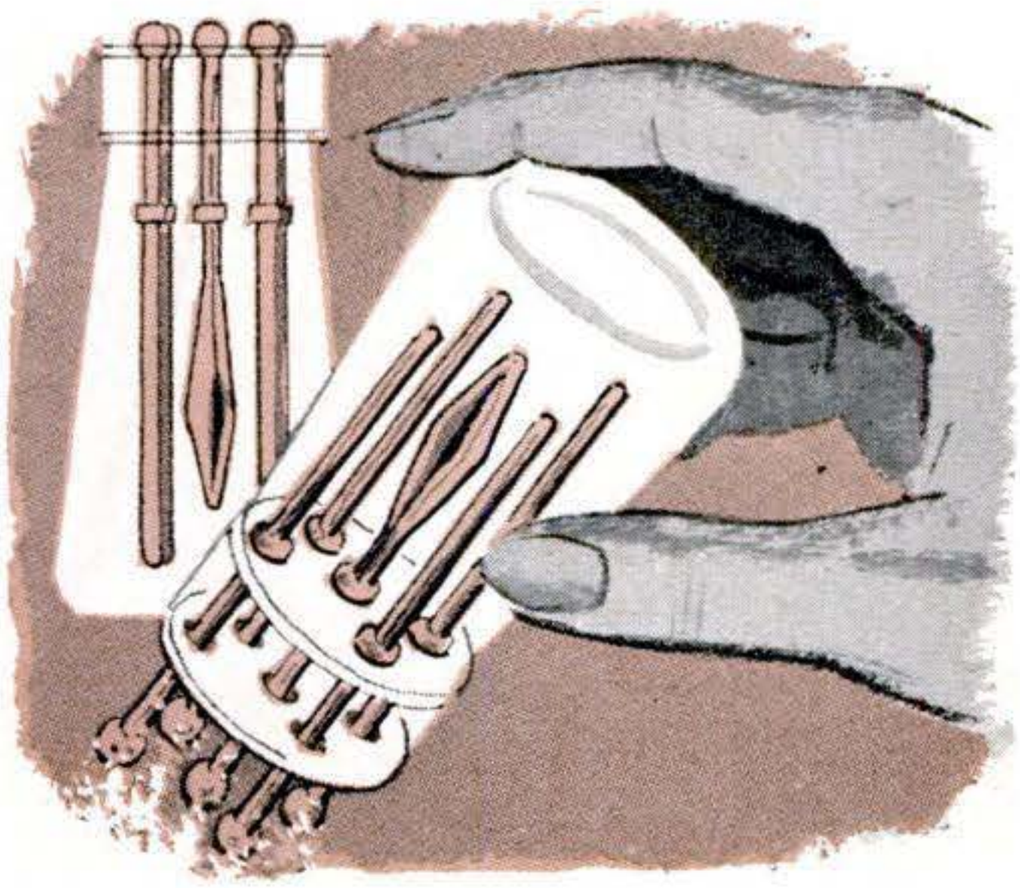
New Ideas

FROM THE INVENTORS



1 Pedals to Troll Boat. Pulleys, pedals and a fishtail prop would allow a fisherman to move and steer his boat while keeping both hands free for rod and reel. The rig could be quickly clamped to any small boat. Four pedals set at right angles on a single shaft would drive the combination rudder and pusher-propeller. By selecting the right two pedals, the operator could move ahead or back, turn in any direction.



2 Shaker to Control Salt. You couldn't accidentally drench your food with salt if the shaker limited the flow. Sliding valves inside this shaker would be fitted with stop collars, so only the salt that reached the holes ahead of the collars could flow through. When the shaker was upright, the knobs on top would seal out moisture.

3 Bumper Ring to Open Bottles. It's a rare picnicker who has never found himself in the woods with a burning thirst, a bottle of cold pop—and no opener. This bottle-opening bumper attachment would solve that problem. It would clip permanently over the bumper so you could never take off for the country without it.

Please turn the page for more new ideas

Copyrighted material

MORE New Ideas from the Inventors

4 Ice-Cream Pop to Catch Drips. Between the hazards of melting ice cream and flaking chocolate, it's a skillful child who can eat a pop without soiling face, hands or clothing. The block of pastry on this pop would stop and absorb the drippings. The cake itself, now properly flavored, would be eaten last.

5 Child's Cup to Be Spillproof. Tots who think it's more fun to throw their milk than to drink it could be trusted with this spillproof mug. Its top plate would have a drinking opening, covered with a hinged flap, and a magnetic-valve air vent. In normal position, air would enter the valve and liquid could flow out. But if the cup were dropped, a ball would seal the air opening and thus cut off the flow of liquid.

6 Rocket "Chutes" to Aim Cargo. Parachute-dropped cargo may wander anywhere a stiff wind takes it, but this bomb-like load carrier could be pinpointed on a target. A proximity fuse would set off rocket brakes at an altitude of about 1,000 feet. Their downward blast would slow the shells and land them gently. A ground-contact release would turn the jets outward so remaining fuel would be discharged safely.

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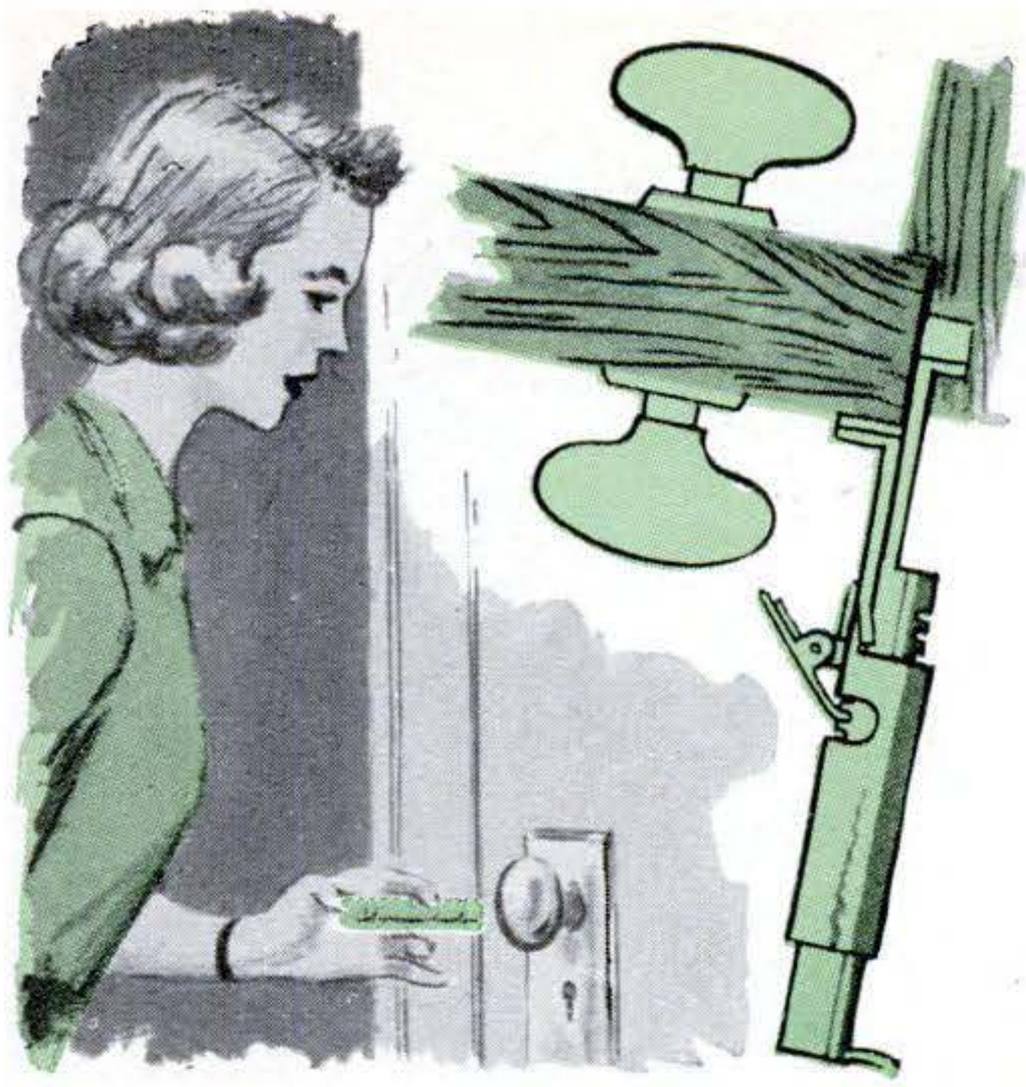
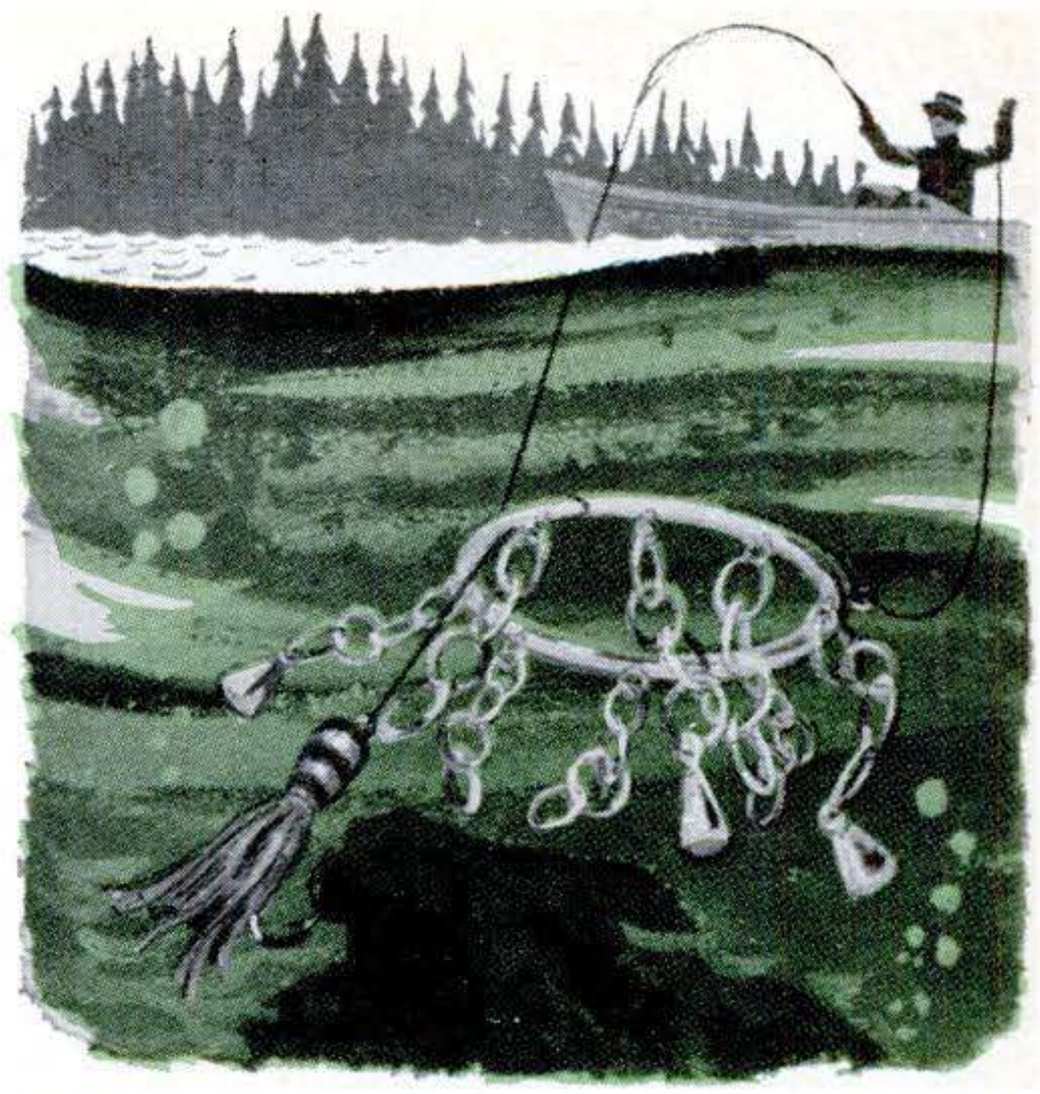
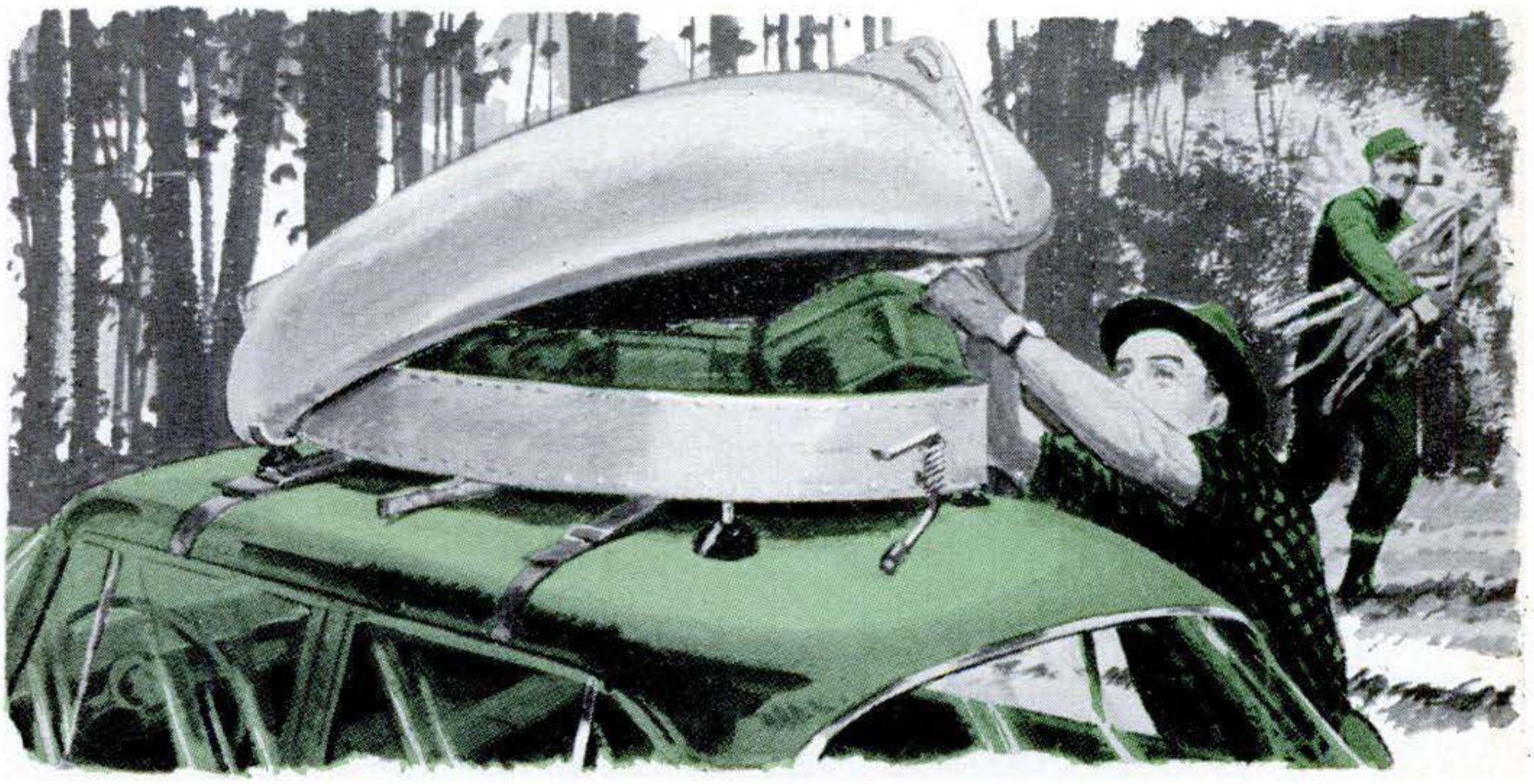


7 Latch to Lock Any Door. A traveler or house guest would have no worries about doors that don't lock if he had this portable latch. One leg of the device would be hooked into the striker plate in the jamb and the second leg pressed up against the door. The door then couldn't be opened until a spring catch was released from inside.



8 Grapple to Free Snared Hooks. Instead of cutting off snagged lures or hooks. this inventor would slip a slotted, weighted collar around his line and allow it to joggle the barb free. If it didn't. chain links on the collar would snare the hook, and it could be yanked free by a separate sturdy line tied to the collar.



9 Car-Top Boat to Tote Luggage. This car-top baggage rack would be shaped and cushioned to form a snug, rattle-free boat support. And the boat would serve as a watertight protective cover for the luggage. Made as a matched combination, the outfit would include a specially designed lightweight boat that could be easily handled and loaded by one man. The supports at both ends of the rack would act like hinges so either end of the boat could be tilted up for access to the baggage. Finger grips in the keel might also be provided for easy handling of the boat.

U.S. patents on these inventions have been granted to: 1. W. Reynolds, Conway, Ark.; 2. J. Von Essen, Floral Park, N.Y.; 3. W. Cowan, Mississippi City, Miss.; 4. R. Sueskind, NYC; 5. W. Dale, Minneapolis; 6. M. Hild Jr., Los Angeles; 7. C. Andrews, Wolcott, N.Y.; 8. M. Richard, Lexington, Ky.; 9. A. Swenson, Cornucopia, Wis.

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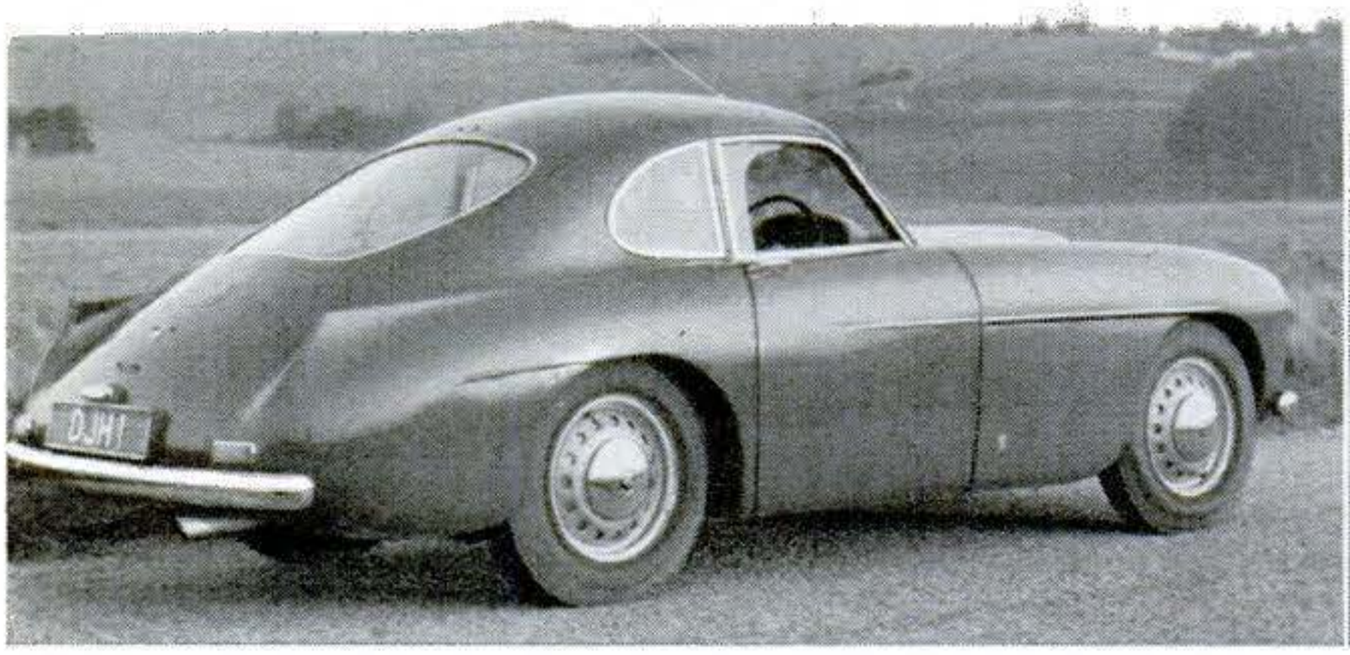
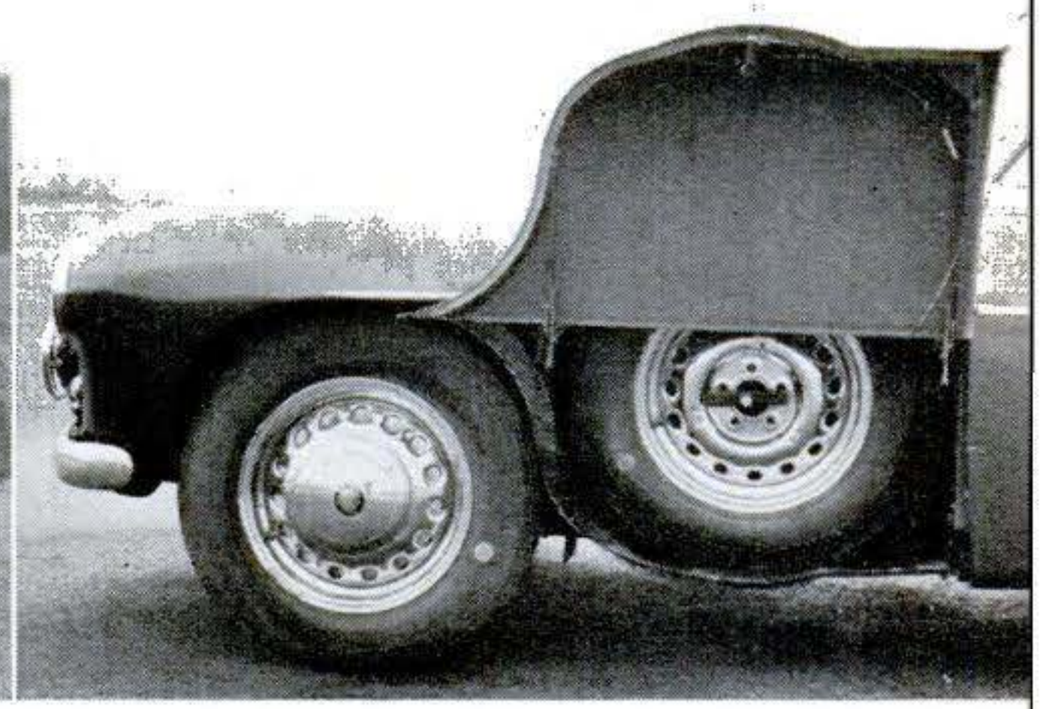
Radar That Once Guarded Fleet Now Brings TV to Desert

OLD radar antennas that once served on battleships now stand 4,700 feet above sea level on dry land. They relay TV programs to a mountain-locked valley in California's Mojave Desert. Several hundred volunteers, mostly from the Naval Ordnance Test Station, anted up $15,000 for equipment, then pitched in to build and man the station.





Spare Tire and Battery Are Hidden in Fenders of This British Car

THE side-mounted spare tire is back—but with a difference. A new British luxury car discreetly nests the spare in the usually empty fender space behind the left front wheel. A similar compartment on the right-hand side of the car conceals the battery. The Bristol 404 is a speedy road car for gentlemen drivers, designed to be "driven with a certain élan." It has no ordinary trunk—oops, boot—but the two small jump seats in the rear compartment fold up to make room for luggage.

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Kitchen in an Elevator Makes Morning Coffee

WHEN you call for a Continental breakfast in your room at Chicago's Palmer House, you get service fast. A "floating kitchen" in an elevator moves from floor to floor. The operator takes orders over a telephone and waiters stand by to deliver trays of fruit juice, rolls, jelly and pots of coffee.

▶▶▶Up in Nova Scotia at the Atlantic Fisheries Experimental Station they've been baking cakes with fish waste. And they taste just like the cakes mother used to make. Treated under high temperatures and pressures, the fish is converted into a foamy product you can't tell from white of egg.

Toy Organ Plays on Radio

THIS tiny electronic organ plays through a radio like a wireless record player when its antenna is draped near the set. It runs on batteries and has a range of two octaves. El-Tronics, Inc., 5th and Noble Sts., Philadelphia, makes the ElTronoVox.

"Gun" Nets Birds for Banding

WEIGHTS shot from these gun barrels drag nets over geese feeding near an atomic-energy plant. Scientists then chart flight patterns of the banded birds to determine where they'd carry radiation contamination in case of accident or war damage at the plant.

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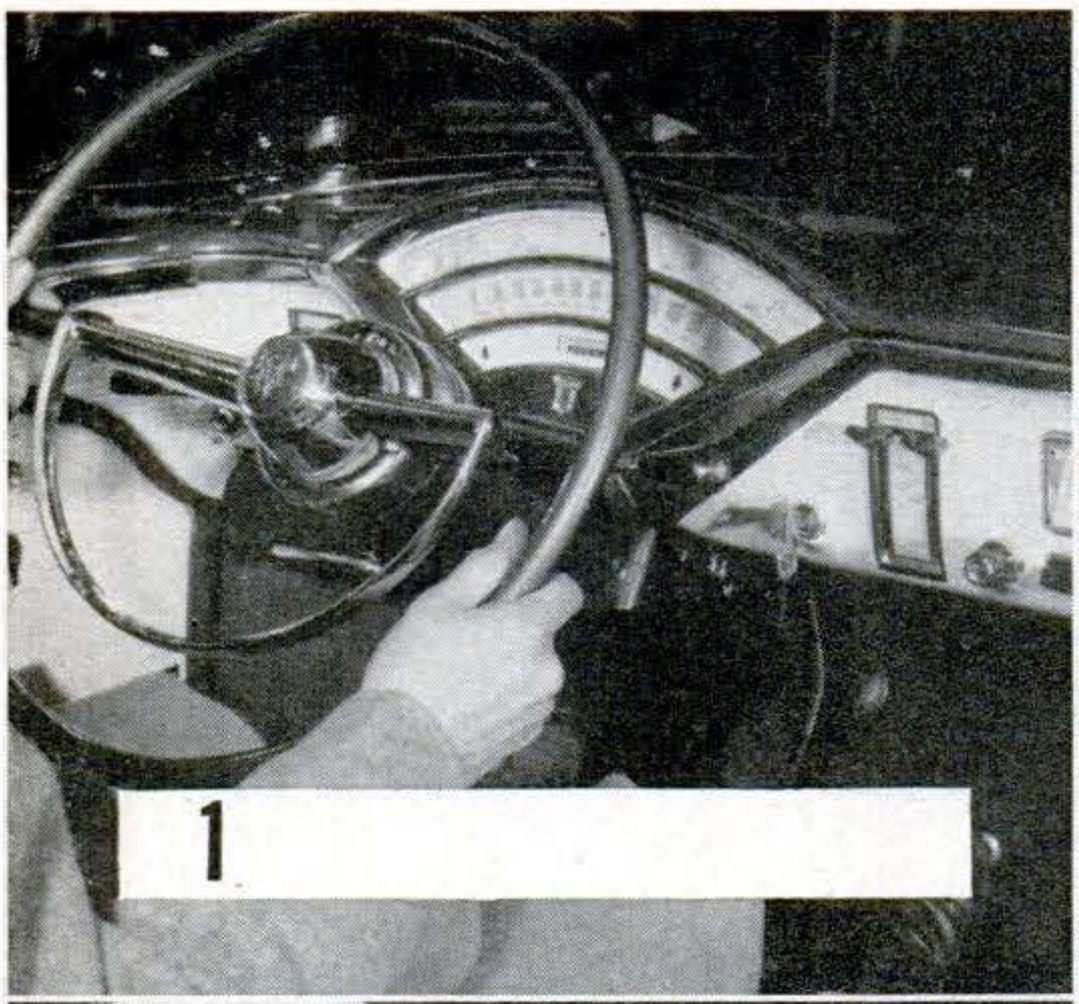
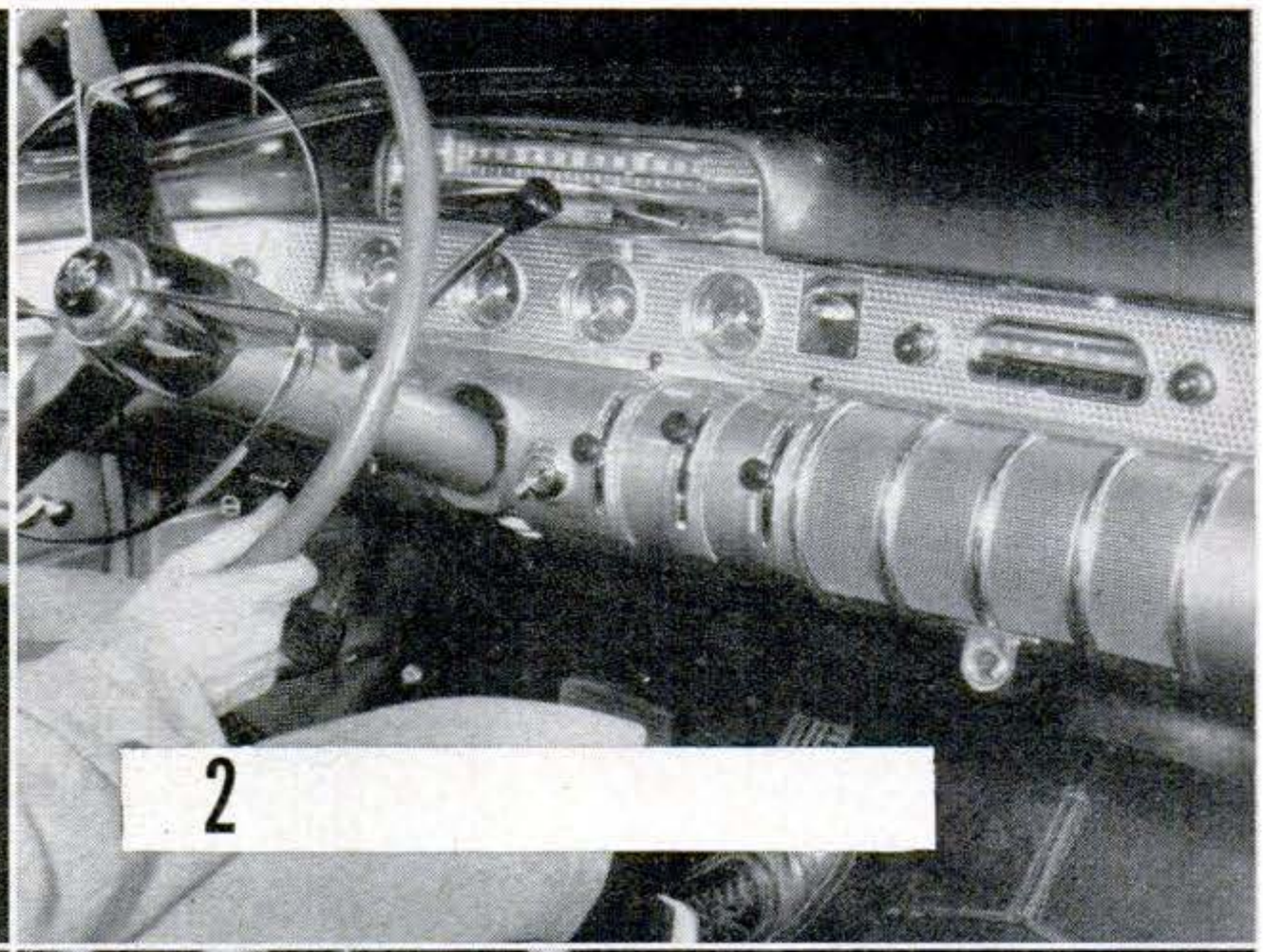
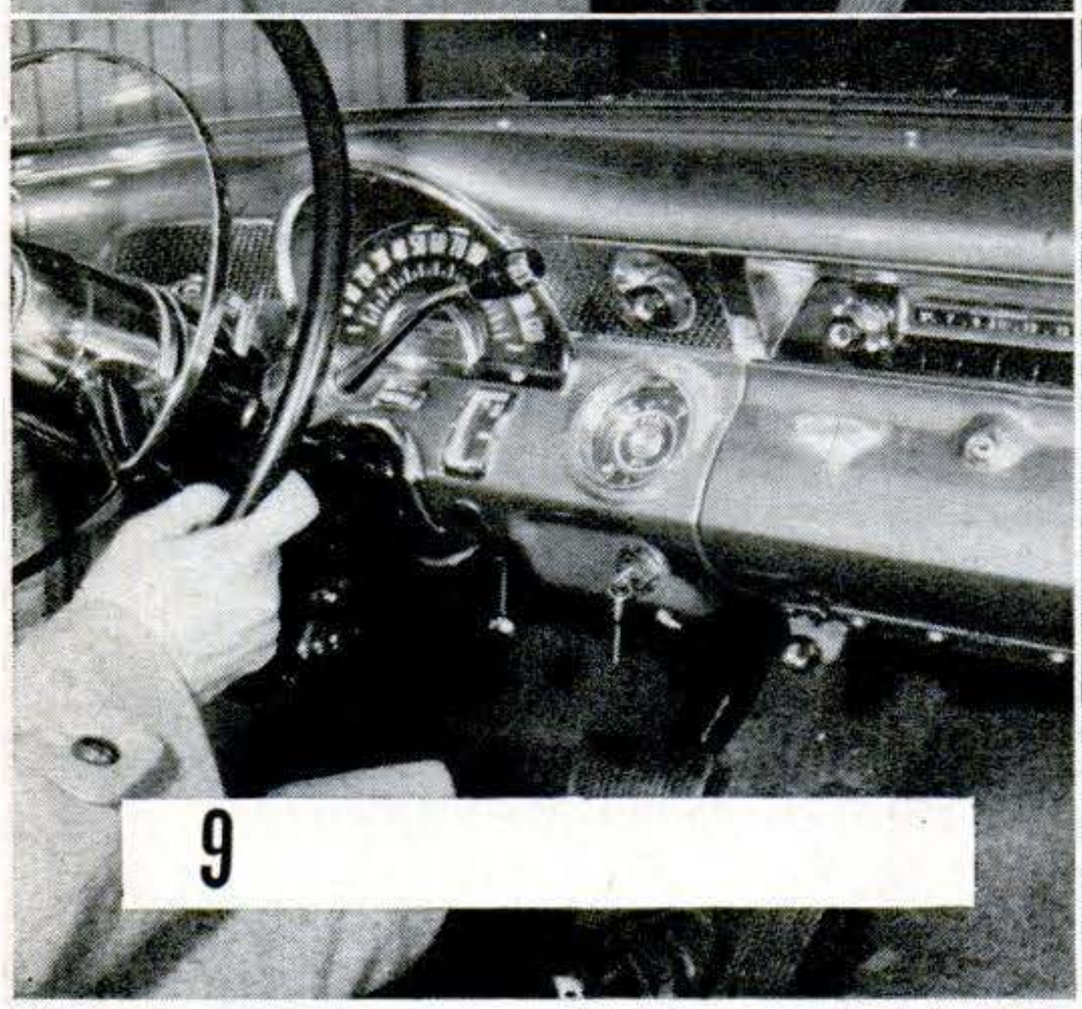
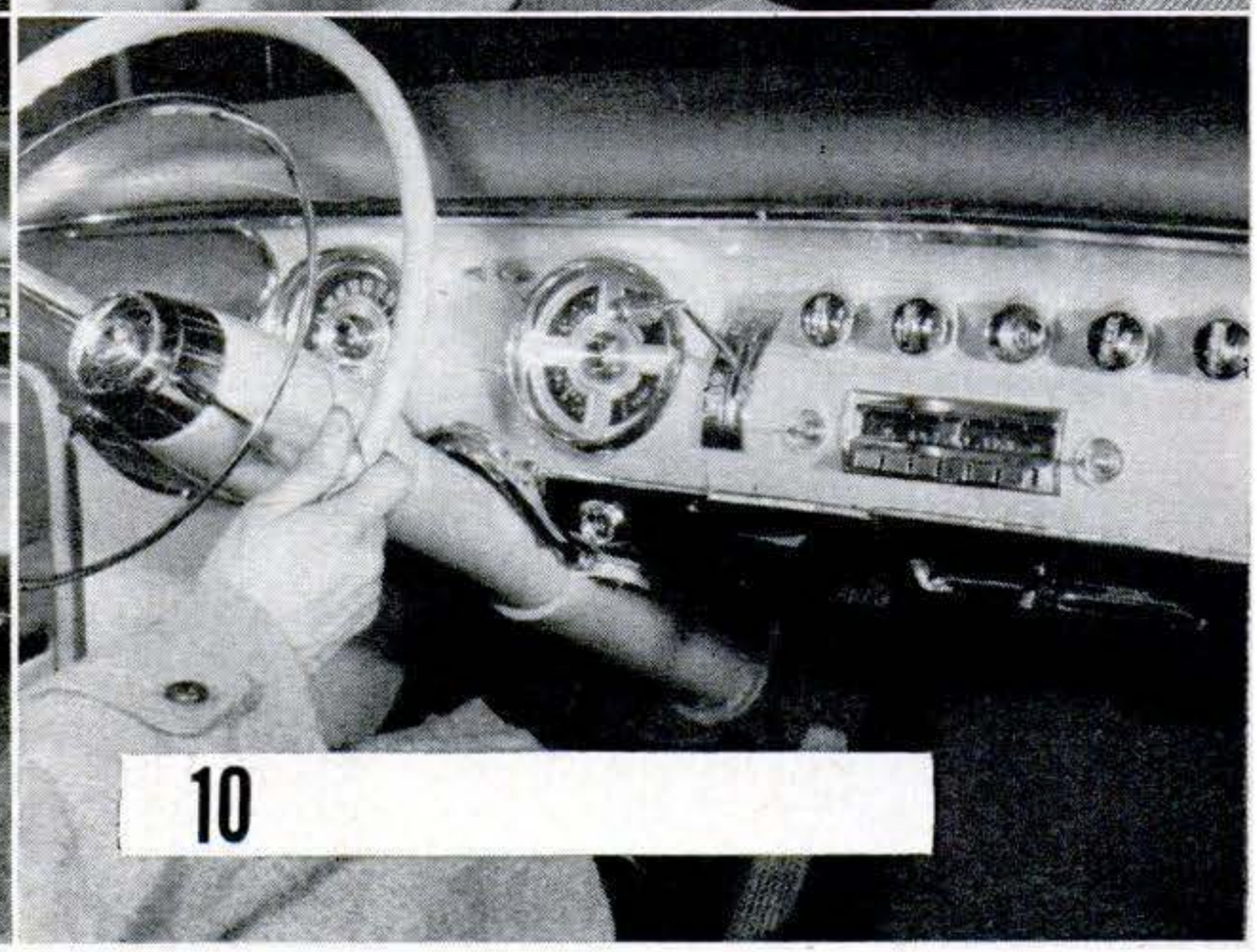
What Car Are You









7. Rambler; 8. Studebaker; 9. Pontiac; 10. Chrysler; 11. Packard; 12. Cadillac.

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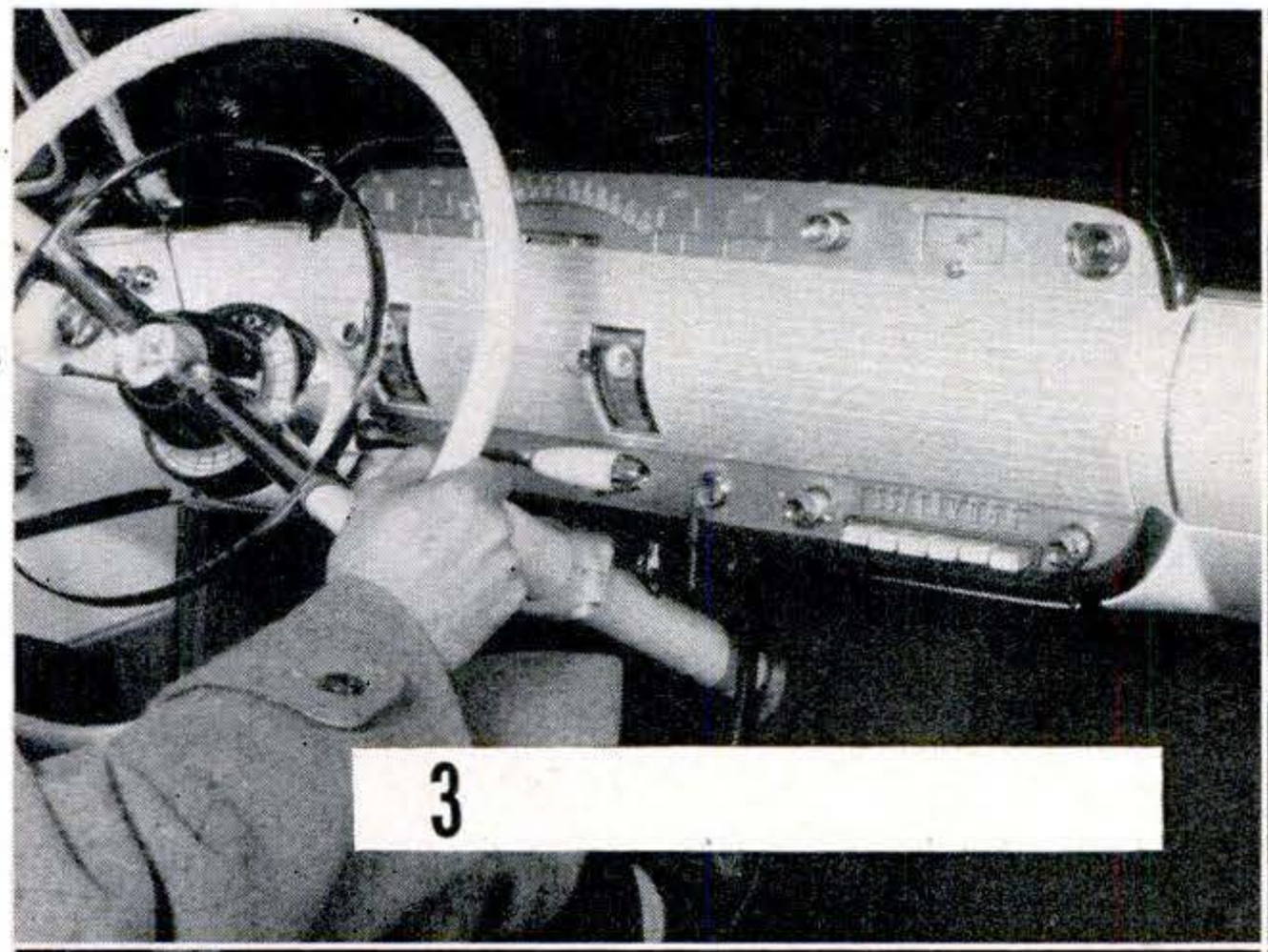
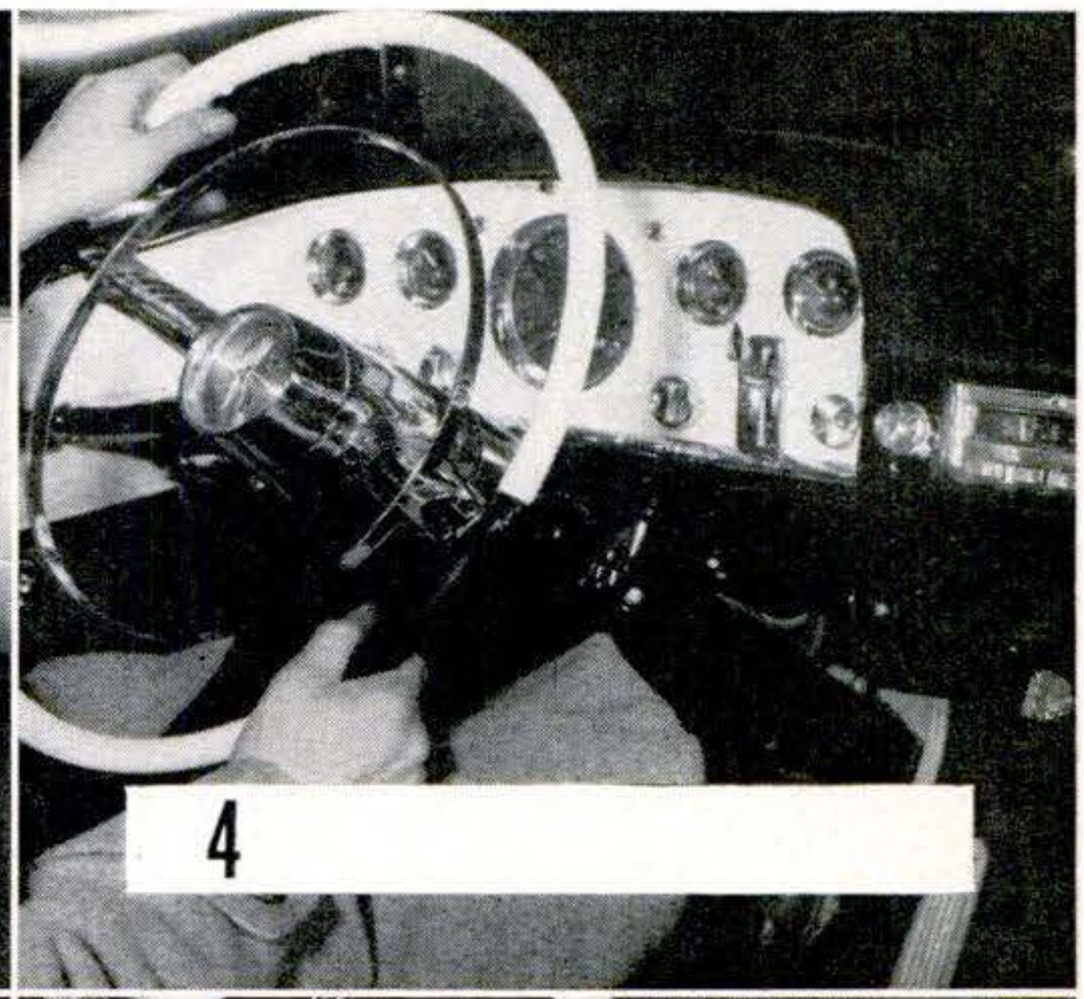
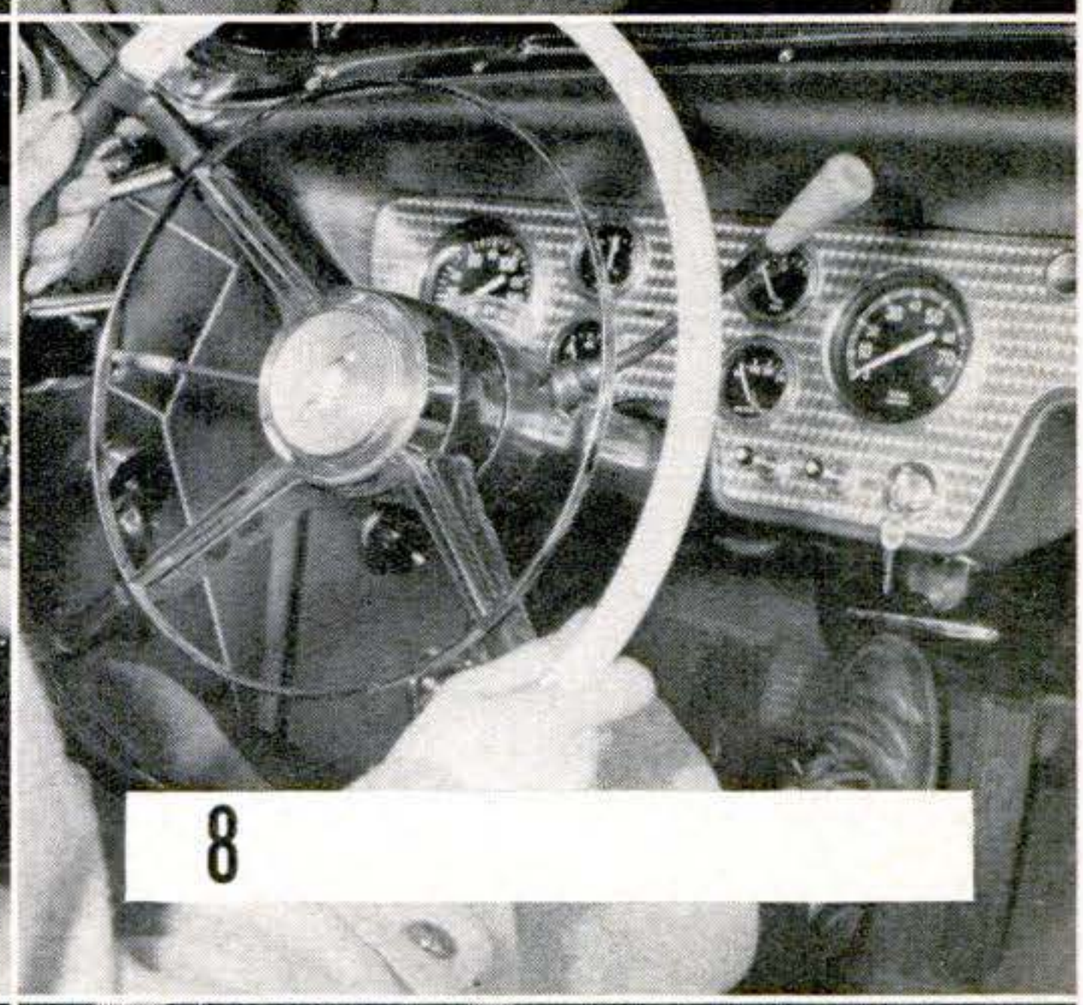
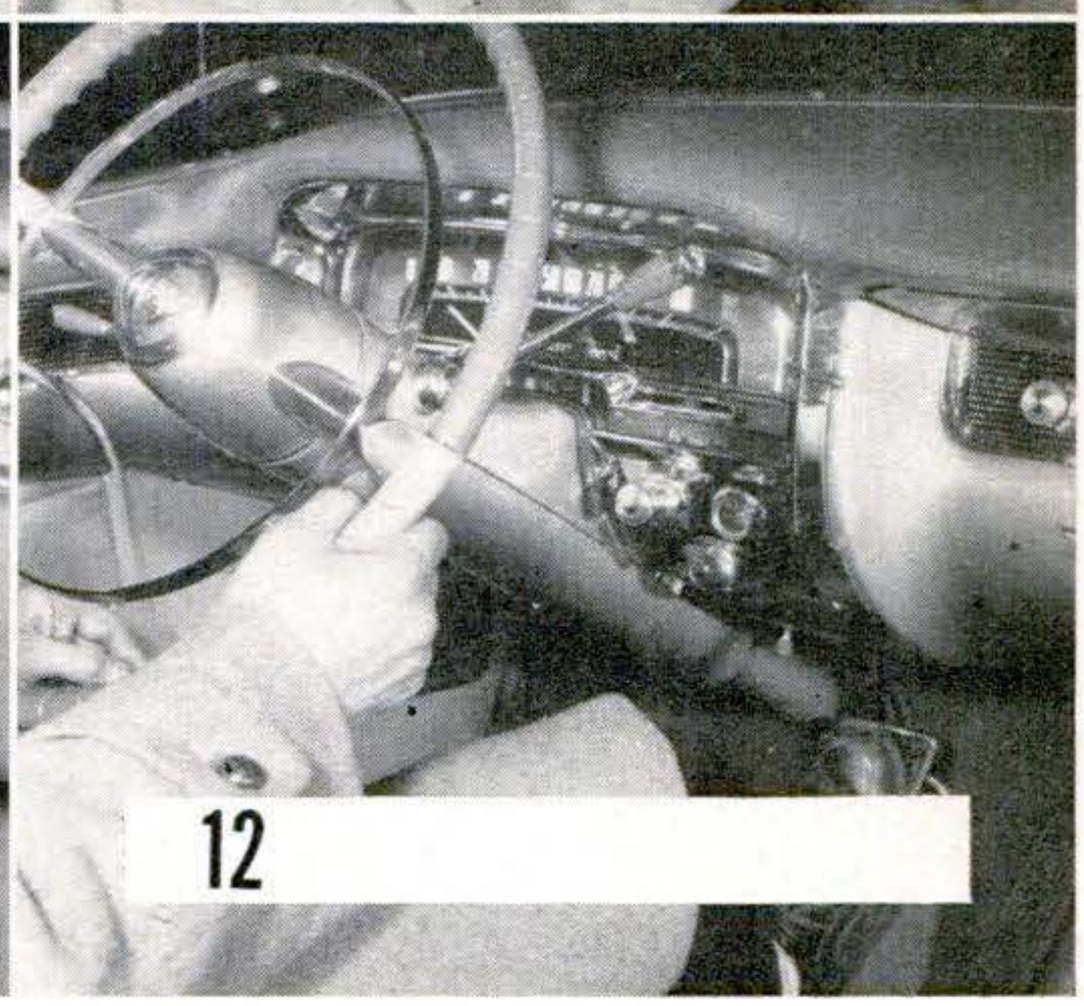
Driving?

PICTURED below are the dashboards of a dozen 1955 cars, with only the names painted out in a case or two. How many can you identify? Write in your guess under each photo; then check with the answers at the bottom.









Answers: 1. Mercury; 2. Buick; 3. Lincoln; 4. De Soto; 5. Dodge; 6. Oldsmobile;

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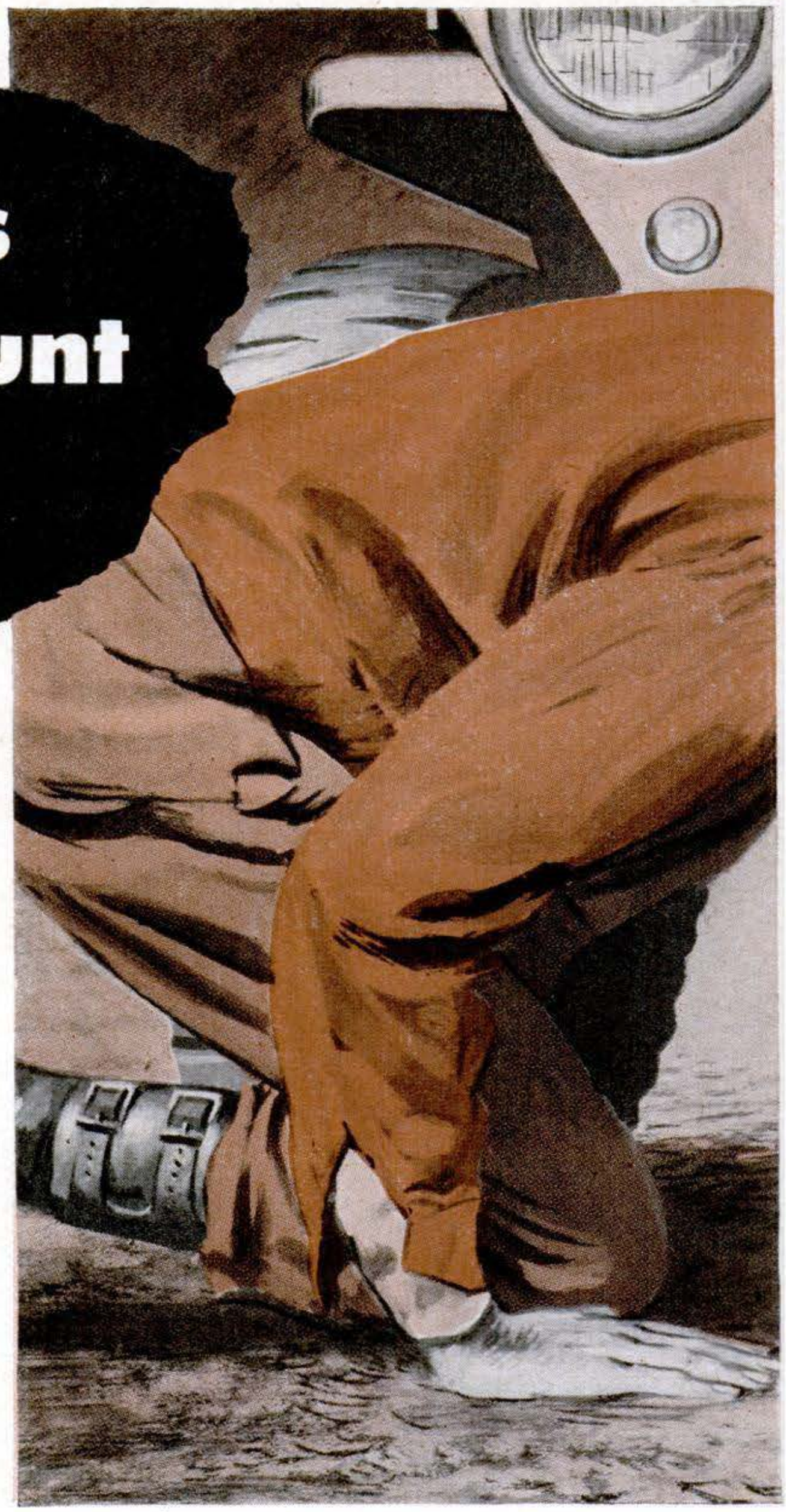
Gus Sparks a Uranium Hunt

By Martin Bunn



GUS WILSON was considerably surprised, early one morning, when Hank and Nancy Stoneman drove into his Model Garage in their Jeep, only an hour after they had started out on their uranium-hunting expedition. Nancy Stoneman was practically in tears.

"We've planned this trip for so long, Gus," she wailed, "and we've only got a week's vacation—we can't waste a minute of it."

"Trouble?" Gus asked, not knowing what else to say.

"You said it, Gus," Hank Stoneman said. He heaved his lanky frame from the Jeep disgustedly. "This crate has been running like a watch ever since I got it a month back—uphill, downhill, empty and loaded. But now, when we start our trip, it throws a rod on the first hill."

"Is that all?" Gus spoke lightly, hoping to dispel their gloom. "You'll soon be on your way—won't take long to put in a rod bearing."

"I wouldn't have planned this trip if the fellow I bought the car from hadn't told me it was in fine condition," Stoneman said bitterly. "It seemed to be, too—didn't even have to add any oil during the time I drove it."

SILAS BARNSTABLE, who had idled over with Pete Vancourt, looked at the Stonemans and sniffed audibly.

"Please hurry, Gus,"

"Maybe," he said sourly, "the automobile ain't one to put up with wild-goose chases all over creation."

"Wild-goose chase!" Stoneman exclaimed. "We might get rich. The Government pays big for locating uranium. Besides, this is a sort of delayed honeymoon for us—we didn't take one when we were married."

"Honeymoon!" Silas snorted. "Rubbish

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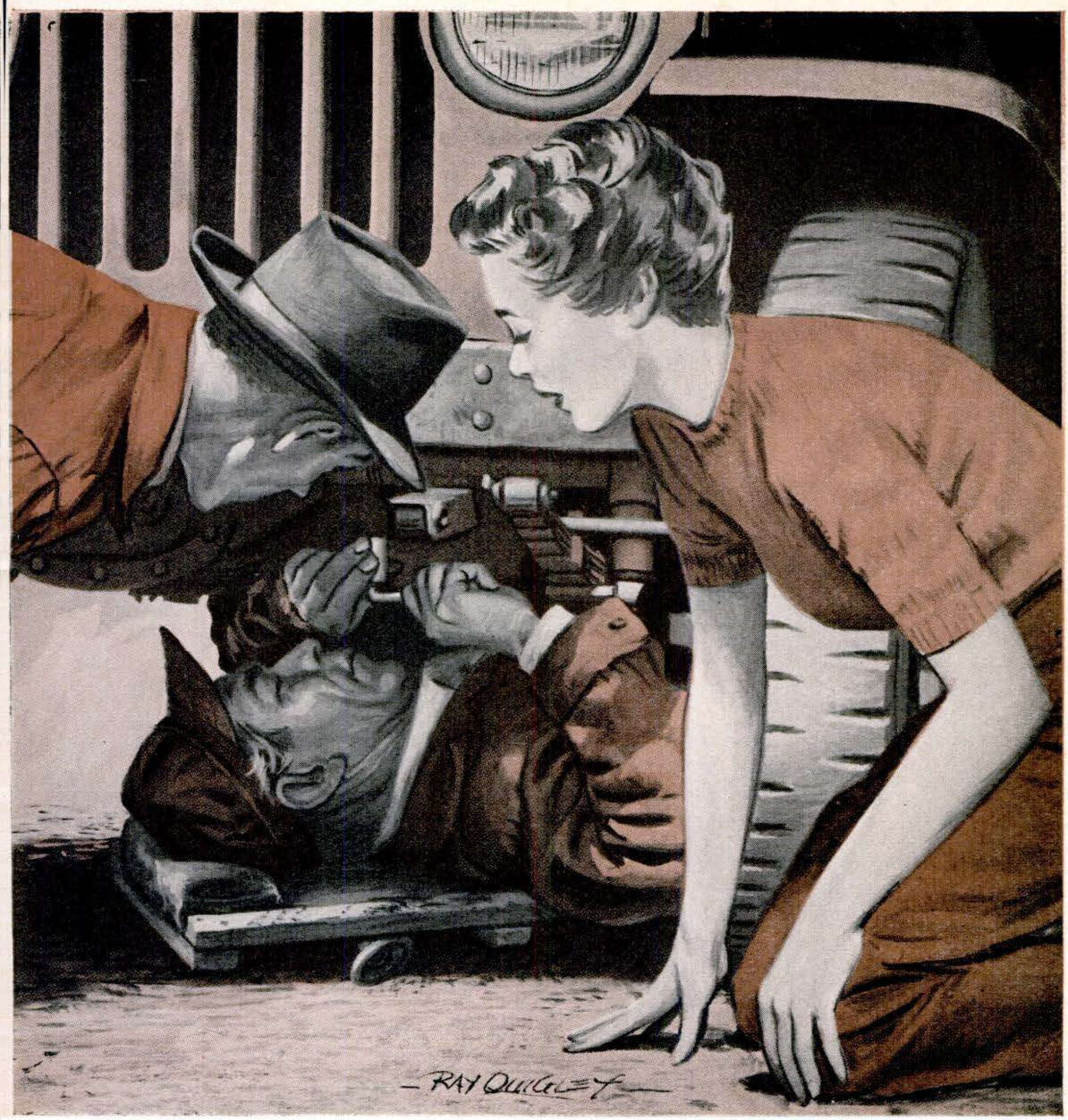

Nancy pleaded. "We're late for our honeymoon."

—chasing around with a tent and skillet like painted Indians."

"Why, you dried-up old coot," Pete Vancourt retorted, "Gus and me and Elmer Stoddard plan to live in a tent on our vacation. Come on, Silas, let's get out of here and let Gus fix the Jeep."

"I don't care what he says." Nancy Stoneman's chin came up. "It's going to be fun. We planned to camp at Meeker Springs tonight. But it's getting late."

"You can still make it, Nancy," Gus said, lifting the hood. "We'll have you on the road in no time."

THAT was what Gus thought at the moment. But when he cocked his ear to the motor, a puzzled expression came to his face.

"Rod out, you say?" he asked. "This

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motor sounds just fine, if you ask me."

"Don't let it fool you, Gus," Stoneman said. "You should hear it on a hill."

"I'd like to," Gus said. "Jump in and we'll see."

The motor sounded sweet until they hit the first steep hill out of town. Then it developed a knock that did sound considerably like a rod bearing. Gus drove back to the garage silently, his mind searching the possibilities. One bum guess, he thought, and these kids lose a day of their vacation. To them that's a year out of their lives.

Back at the garage, Gus wiggled the throttle from idle to quick pickup, held it at medium cruising a moment. Very queer, he thought. A rod comes in sharpest from idle to pickup, a wrist pin on idle, a piston at sustained, unloaded revolutions. But there was no knock here. Could it be a main bearing?

But with the pan off, he could find nothing wrong with the mains. He didn't take any chances on the rods. He pulled the caps, inspected each one for snug fit. One of the center rods had a small piece broken out of the very center of the shell.

"Ah!" Gus grunted, as he pushed himself out to get a new bearing shell.

WITH this installed, Gus continued to probe for trouble, turning the shaft, watching the rods turn on their journals, looking for side play that would spell misalignment and a possible knock. Then he put the pan back on and poured in the drained oil, which appeared new.

"Just put in new oil, didn't you?" he remarked.

"Yeah," Hank Stoneman said. "Scott changed it last night."

"Fine," Gus said. "Hop in, and we'll try her out."

It seemed to Gus that he'd never heard a smoother-running Willys engine—until they hit the first steep hill out of town. Then the knock came back, as strongly as before. Gus said nothing as he turned back to the Model Garage, but his face was drawn and thoughtful. Nancy Stoneman was eagerly awaiting their return, all smiles.

"It isn't fixed," she said, seeing the answer on Gus's face, and her smile went away. Her eyes strayed to the clock on the wall.

GUS ran his hands nervously through his grizzled hair, his mind racing. Nothing wrong underneath—it had to be somewhere on top. He found himself taking a compression check, hoping that a sticking valve might be striking a tappet push rod. He checked valve settings, timing, ignition wiring—fiddling around. He looked at the clock—two hours gone.

"He's had so much pleasure out of that old car."

"Can't you find the trouble, Gus?" Nancy Stoneman asked anxiously. "We came to you because we were sure . . ."

"Thanks," Gus grunted, angry with himself. Was he a mechanic or a backyard tinkerer? Again he reviewed the facts. Sure he'd found a cracked rod, but the bearing was snug—he felt at the time that it wouldn't have caused that knock. His ear had told him, right at the start, that the knock was timed to the revolutions of the main shaft. The trouble was down there—why was he wasting time up here? He crawled under again and removed the pan.

Gus lay there, looking at the bottom of the motor, asking himself what he could have missed here—the mains and rods were right, there was proper alignment and side clearance. A drop of oil fell from the round, floating oil-suction assembly, with its protecting screen. Gus wiped the oil from his weathered cheek impatiently, began to probe the bottom

[Continued on page 234]

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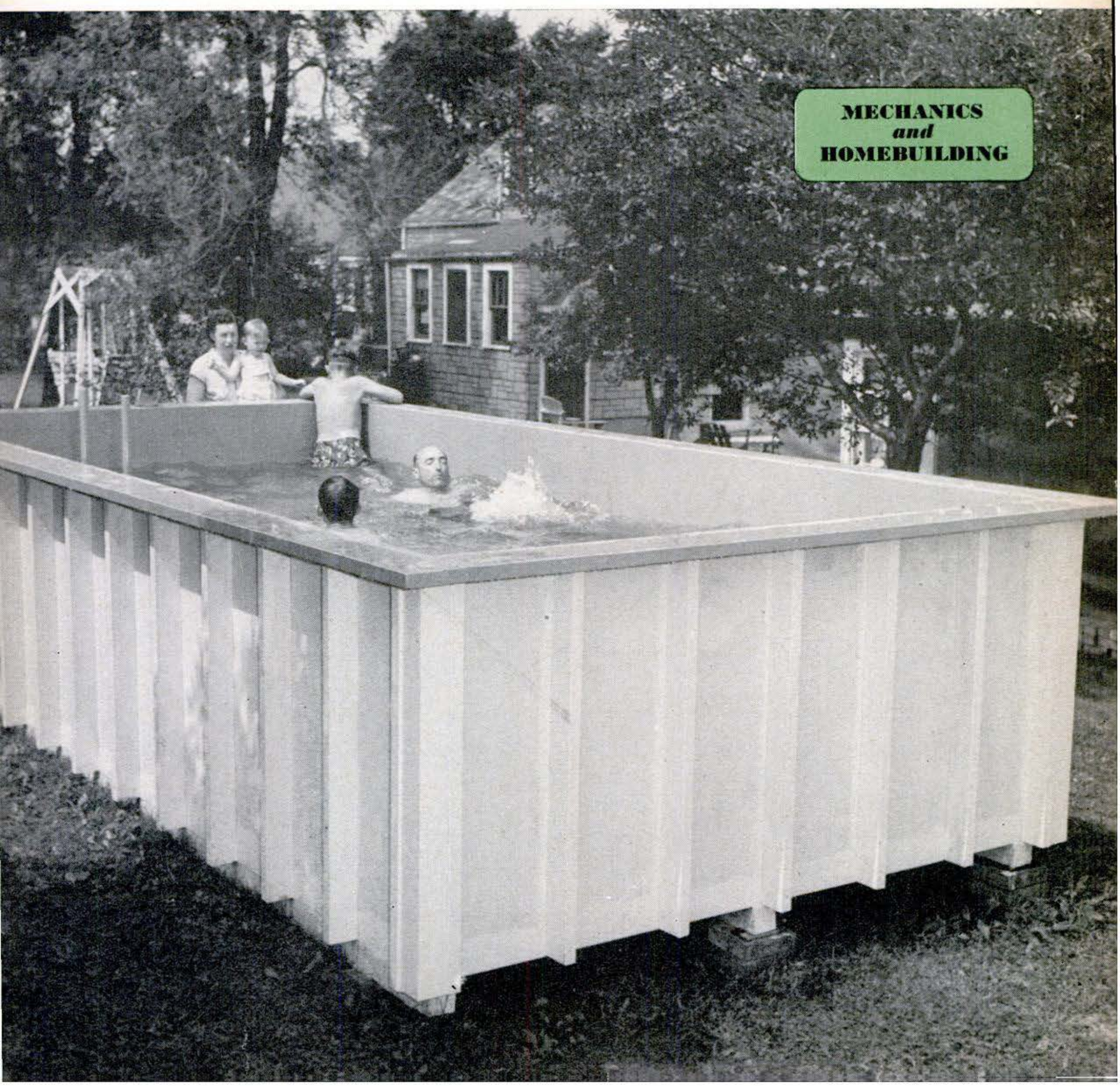
Plywood Swimming Pool Built in Two Weekends

BUILDING a back-yard swimming pool won't break your back or your bank account if you take a tip from Charles Hitney, a TV serviceman in Lisle, Ill. His 8′-by-16′ plywood pool cost only $109.26 and he built it in two weekends.

Built aboveground so that his two-year-old daughter couldn't tumble in, the pool has walls and bottom of ⅜″ exterior-type plywood ribbed with two-by-fours. Two-by-eights cap the 4′ walls.

Starting with two-by-fours cut to 7′8¾″



Steps in building the pool

1 FLOOR FRAME was assembled on ground. Rib two-by-fours were cut to 7′ 8¾″ length to make assembly exactly 8′ by 16′.

2 FOUR STANDARD SHEETS of ⅜″ waterproof plywood, each 4′ by 8′, covered the frame without cutting when placed crosswise.

length for the floor ribs, he assembled them on 16″ centers between two 16′ side stringers, driving two 16-penny spikes into each joint.

On this 8′-by-16′ frame he laid a flooring of four standard four-by-eight plywood sheets, placing them crosswise. The sheeting was secured with aluminum 6-penny nails spaced every inch after calking compound had been forced into the joints between the sheets.

Supporting the tank. Once the floor section was complete, it was raised from the ground and three four-by-fours 16′ long were placed underneath, one down the middle and one along each edge. These longitudinal rails, designed to carry the weight when the tank was filled with water, were leveled on piles of brick.

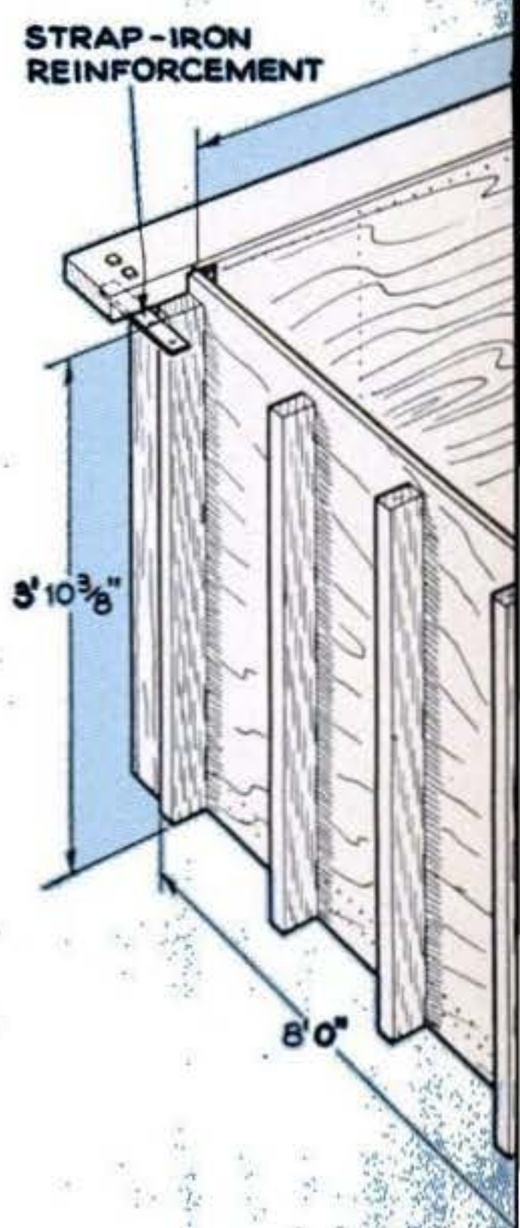
The side sheeting was then nailed in place, and the two-by-eight cap was run around the top edge.

Uprights go on. Next, the two-by-four uprights were nailed on 16″ centers. As a precaution against the stiffening effect of the uprights throwing the pool out of line during construction, they were nailed on first at the corners, then in the centers of sides and ends, and so on. Five-inch lag screws were used to anchor uprights to floor framing. Last to be added were the four-by-four corner posts.

After the pool was solidly tied to-

What you need to build the pool

Pcs.	*Description*
10	*panels ⅜″ waterproof plywood, 4′ by 8′*
13	*two-by-fours 8′ long (cut to 7′ 8¾″)—bottom ribs*
2	*two-by-fours 16′ long—bottom longitudinals*
40	*two-by-fours 4′ long (cut to 3′ 10⅜″)—uprights*
3	*four-by-fours 16′ long—floor supports*
4	*four-by-fours 4′ long (cut to 3′ 10⅜″)—corner posts*
2	*two-by-eights 18′ long (cut to 17′ 3″)—top rim*
2	*two-by-eights 8′ long—top rim*
2	*¾″ coves 16′ long*
2	*¾″ coves 8′ long*
4	*¾″ coves 4′ long*
40	*lag screws 5″ long*
2	*boxes 6-penny aluminum nails*
3	*lb. 16-penny spikes*
5	*tubes calking compound*
1	*gal. blue enamel*
1	*gal. house paint*



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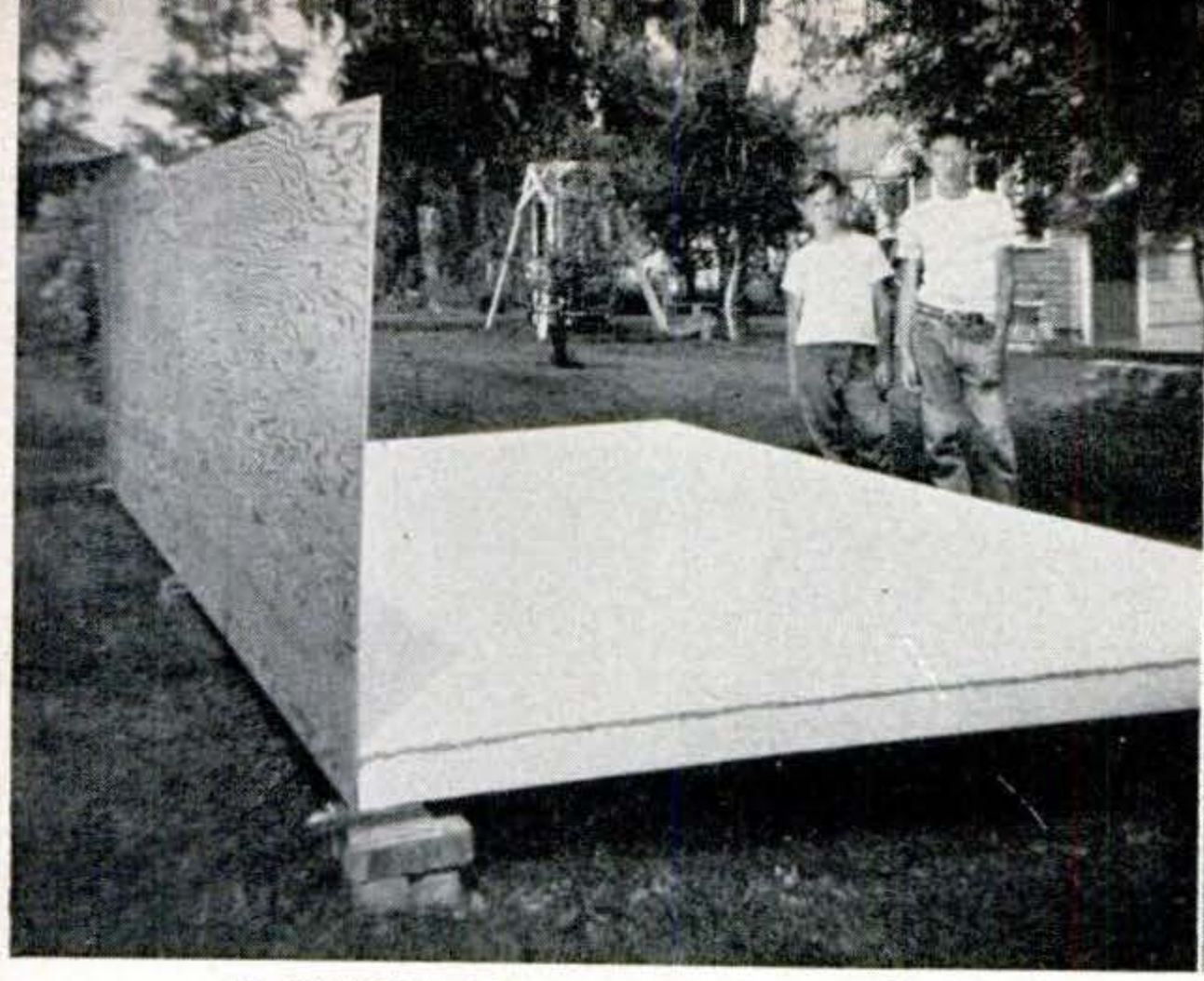
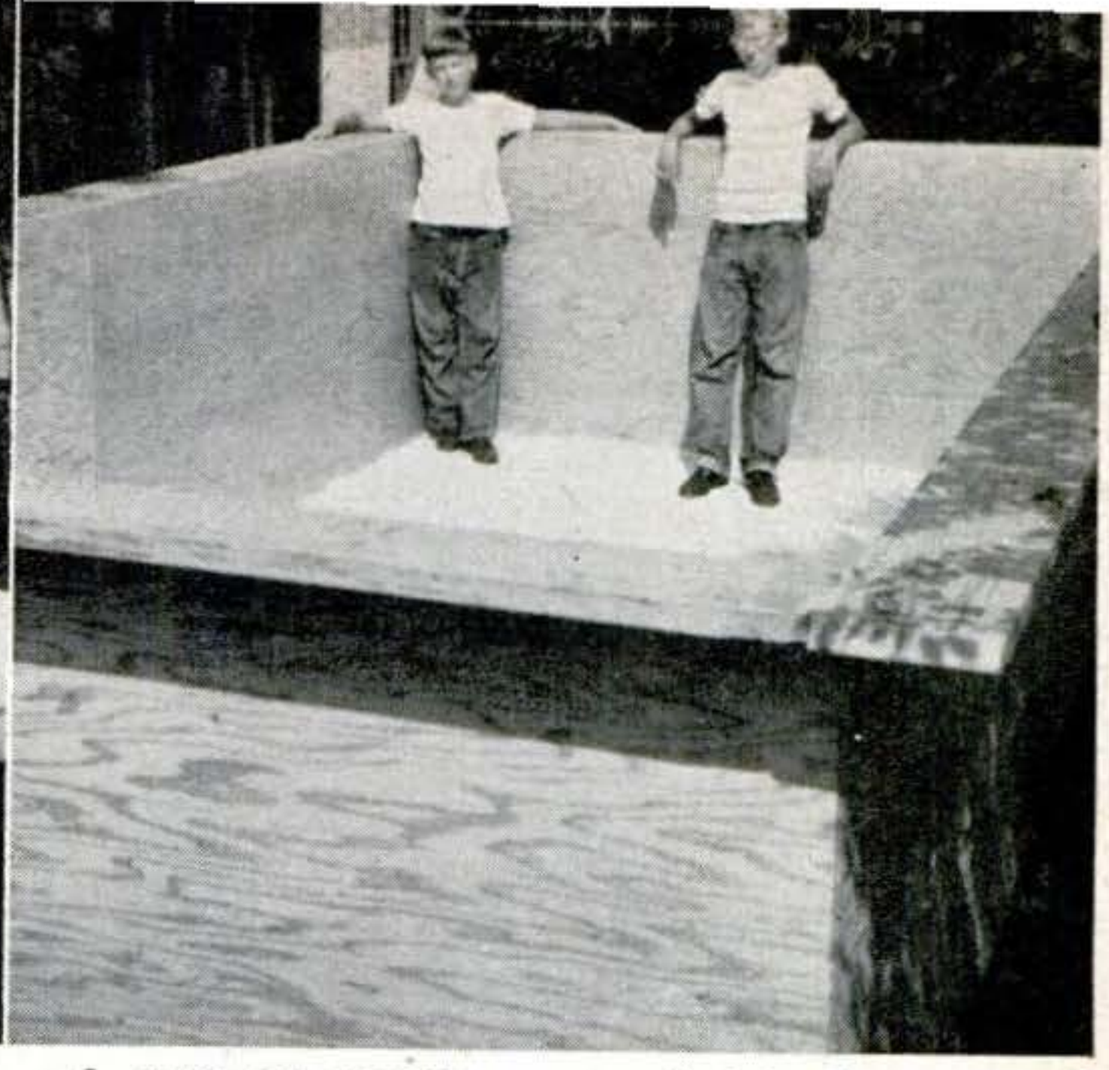
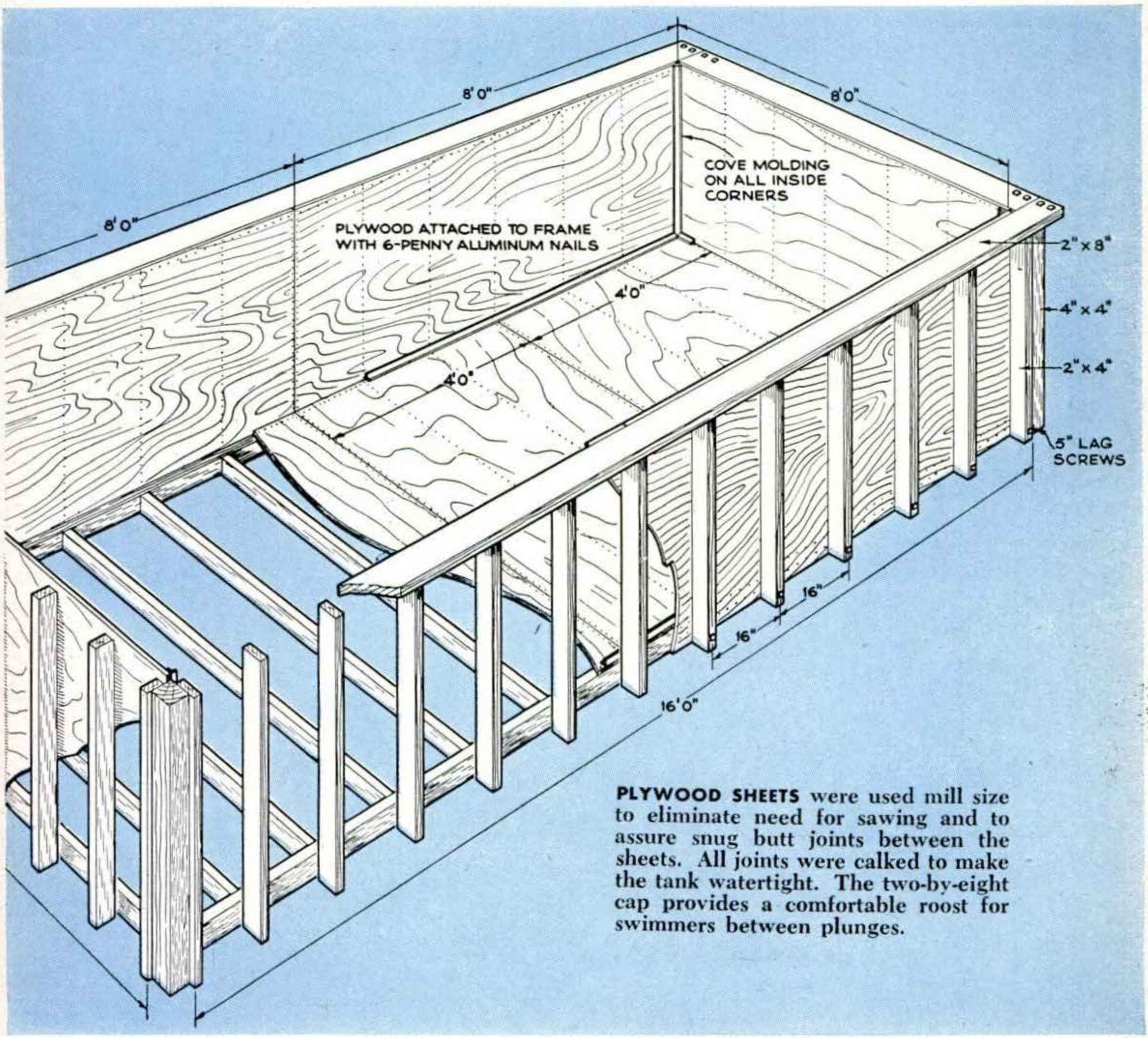


3 WALLS CAME NEXT, two 4'-by-8' plywood sheets on each side and one on each end. The floor was elevated on piles of bricks.



4 TWO-BY-EIGHTS were nailed in place around top of walls—and the builder's sons had a chance to try pool for depth.



PLYWOOD SHEETS were used mill size to eliminate need for sawing and to assure snug butt joints between the sheets. All joints were calked to make the tank watertight. The two-by-eight cap provides a comfortable roost for swimmers between plunges.

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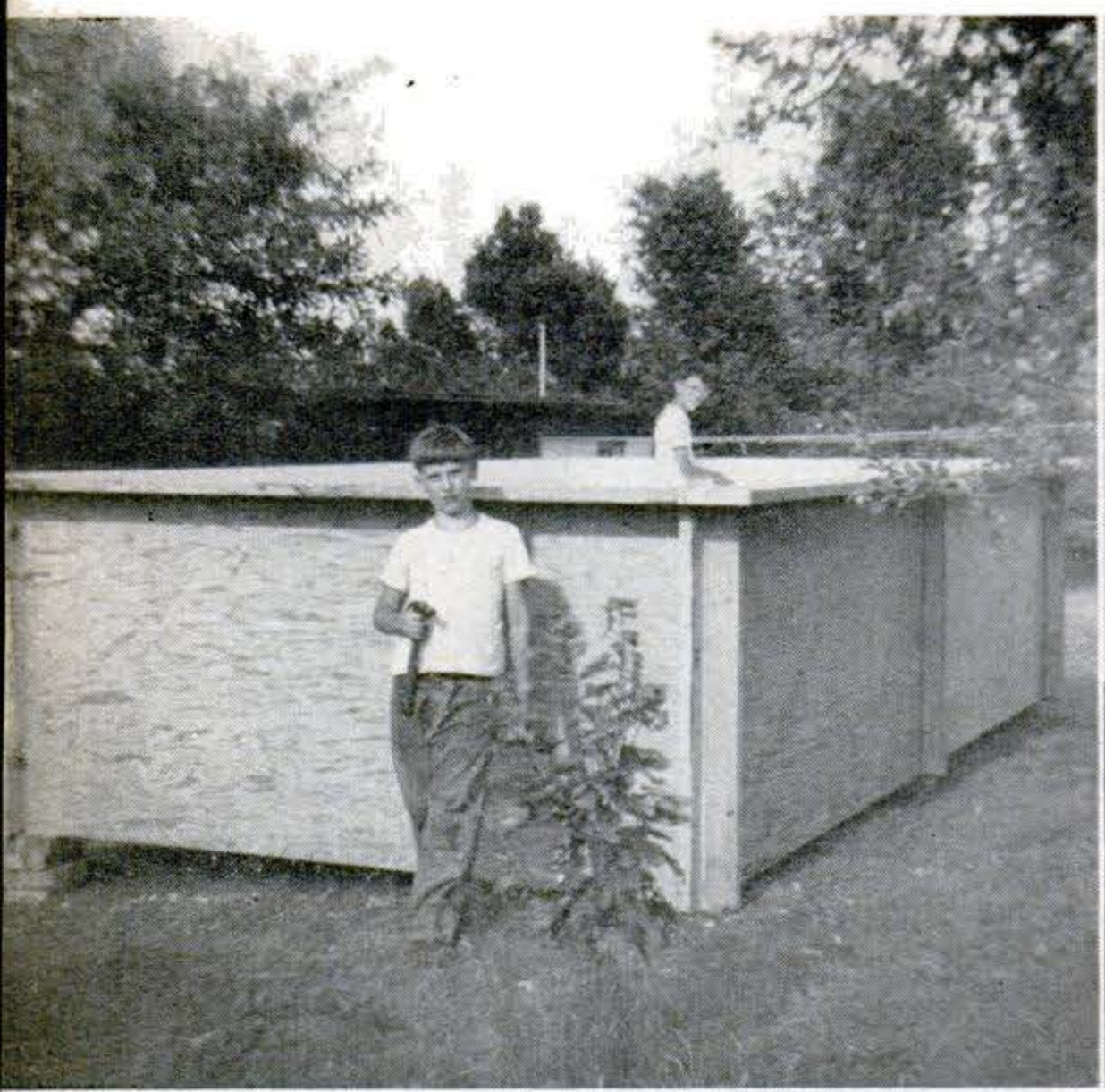
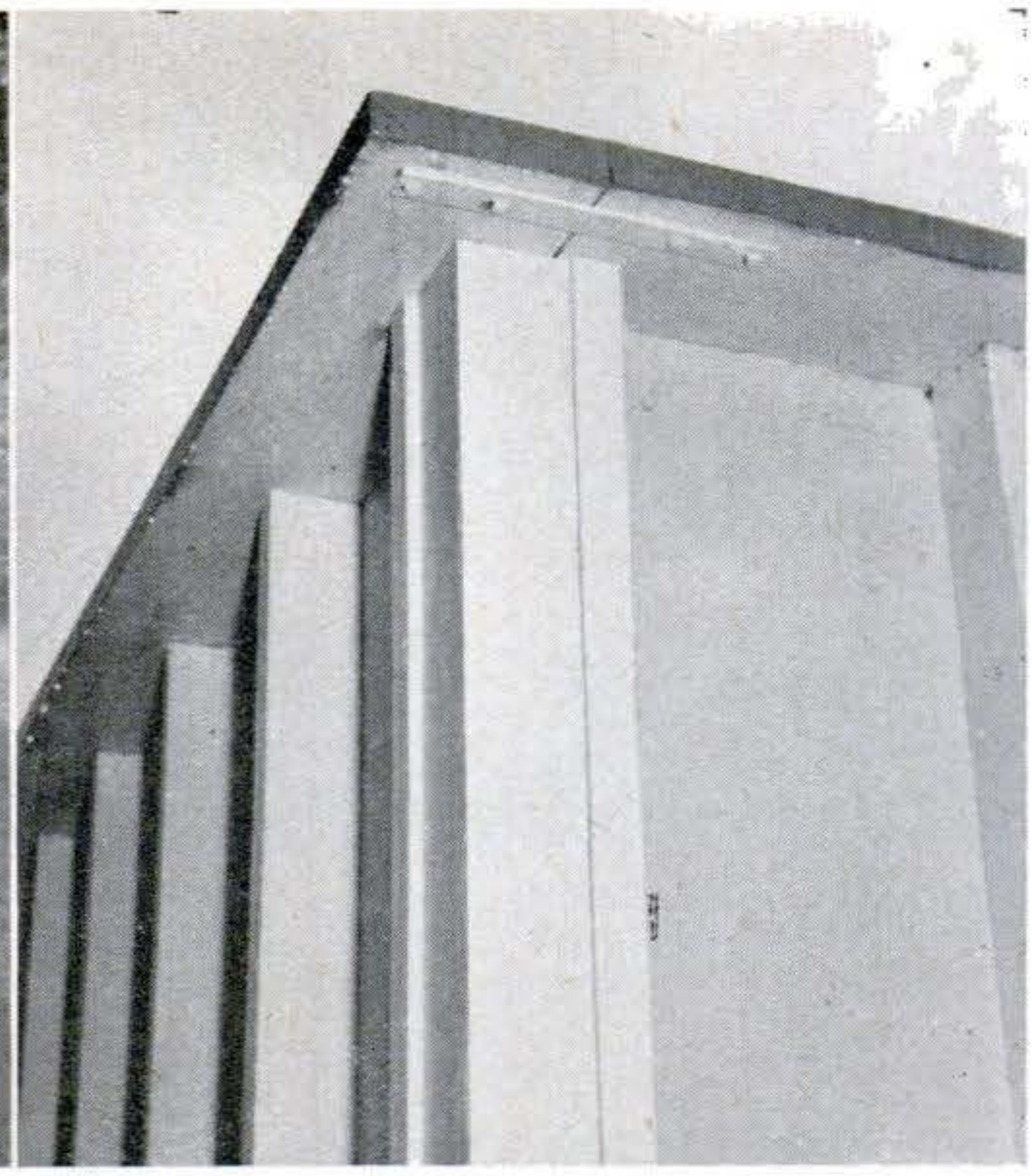


5 UPRIGHT BRACES were positioned by nailing down through top cap and running lag screws through each into floor frame.



6 FOUR-BY-FOUR CORNER POSTS were final construction detail. Notice metal strap used to tie together two-by-eights at corners.

gether, Hitney calked its inside corners and nailed ¾″ cove molding over each joint with finishing nails.

Paint finishes it. A gallon of pale yellow house paint applied to the outside, and the same amount of blue, four-hour enamel brushed onto the inside made it look the way a swimming pool should.

Entrance to the pool is via two short ladders: a small stepladder reaching to the rim, and a permanently fixed set of rungs leading down into the water.

For the first season after Hitney built his pool, he filled it with cold tap water from his well, changing the water about twice every week or 10 days. Used water was siphoned off. Filling took about a day, and he depended on atmospheric temperature to warm the pool. This season he is installing a gas heater on his back veranda to take the chill off the water.

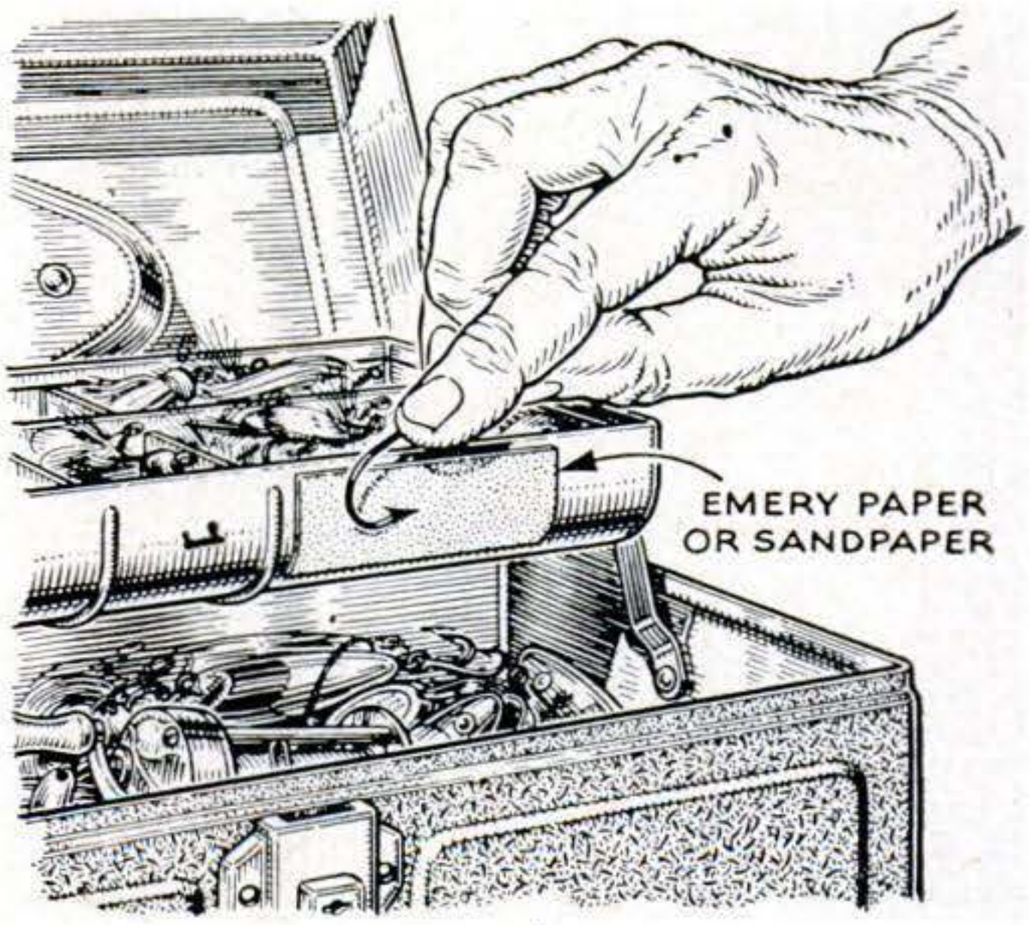
Rain water, dirt and leaves are kept out of the pool with a colorful corrugated glass-fiber panel which clamps over the top.—*Kenneth Wylie.*

Sandpaper Sharpens Fishhooks

A SMALL piece of abrasive paper glued to the tray or lid of your tackle box will always be handy for sharpening fishhooks. Since the hooks dull quickly when dragged over rocks, they should be repointed often.—*Fred M. Pease, El Paso, Tex.*

Nail Polish Has Workshop Uses

A DIME bottle of colorless nail polish containing its own brush has many uses. With it you can apply a protective coat of lacquer to jewelry, decals and other small items, or preserve the color of silk or nylon seizings when you varnish a fishing rod.—*Harry Nelson Webster, Nutley, N. J.*



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Making camp is a five-minute chore for the outdoor-minded Moffett family. Their roomy

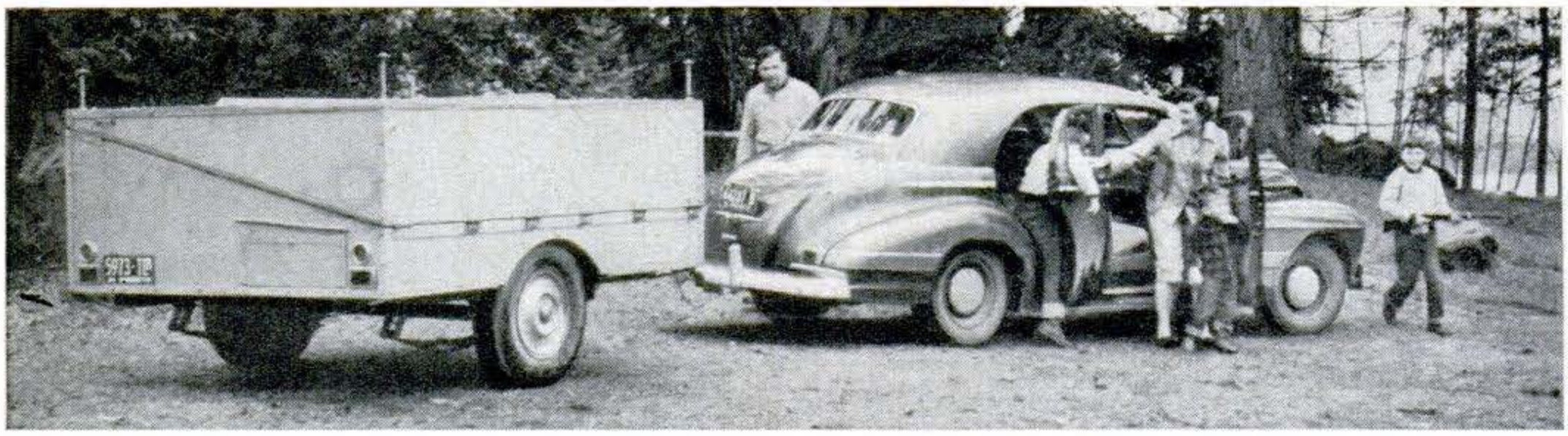
Tent Trailer Opens Like an Umbrella

By John Burroughs

GOING camping, Bob Moffett believes, is the best way in the world to spend a summertime weekend. His wife Lorraine thinks so, too. Their three youngsters, boys aged 10, eight and three, all approve.

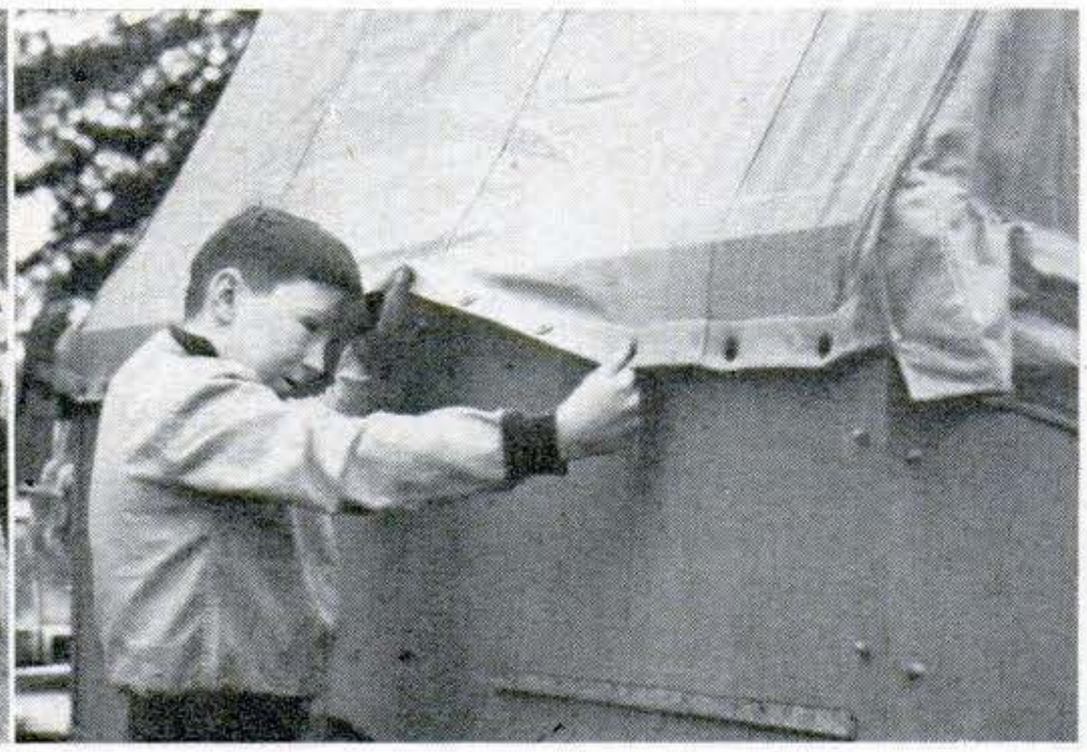
It's just a few hours' drive from their home in Tacoma, Wash., to the ocean-side—to long, empty stretches of beach where green Pacific surf washes the sand, and a sheltered camping site where they can build a driftwood fire and bake a salmon. A week later they can travel inland, following roads winding up through forested slopes to an alpine park somewhere in the coastal moun-

Here's how the Moffetts set up their tent—in five minutes flat

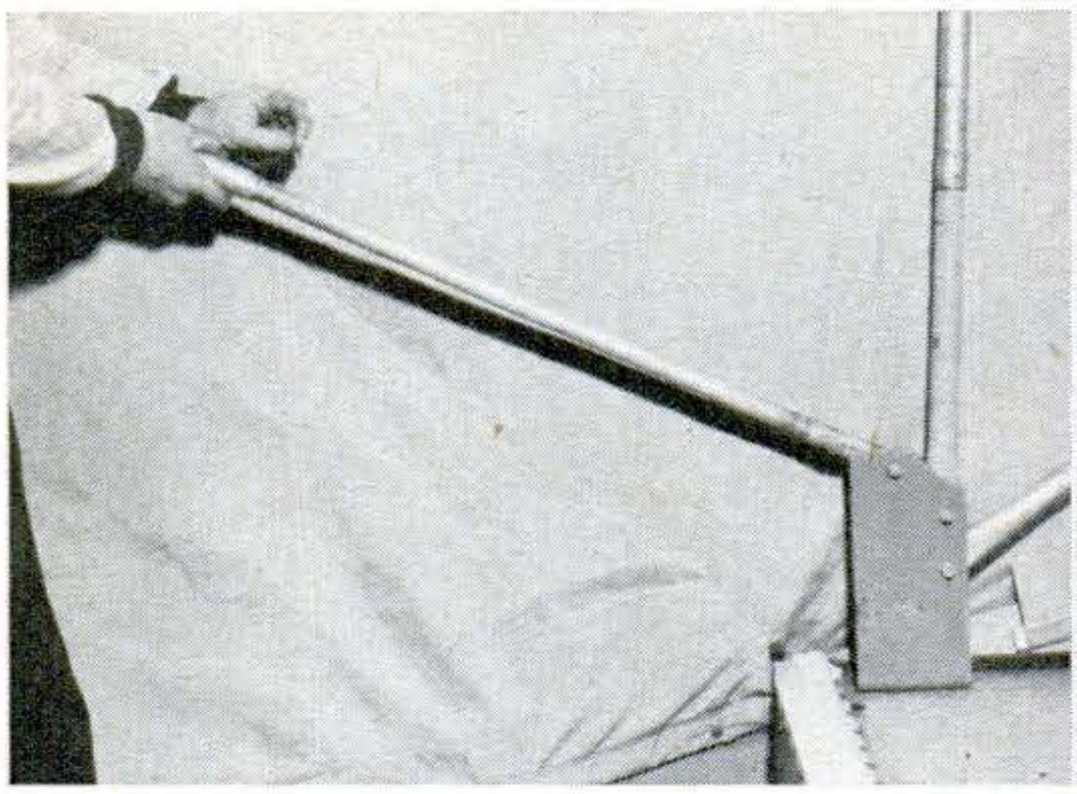


1:00 P.M. The Moffetts arrive at their camp site, deep in Washington's coastal range. While one of the boys holds off the Injuns, Lorraine and Bob head for the trailer.

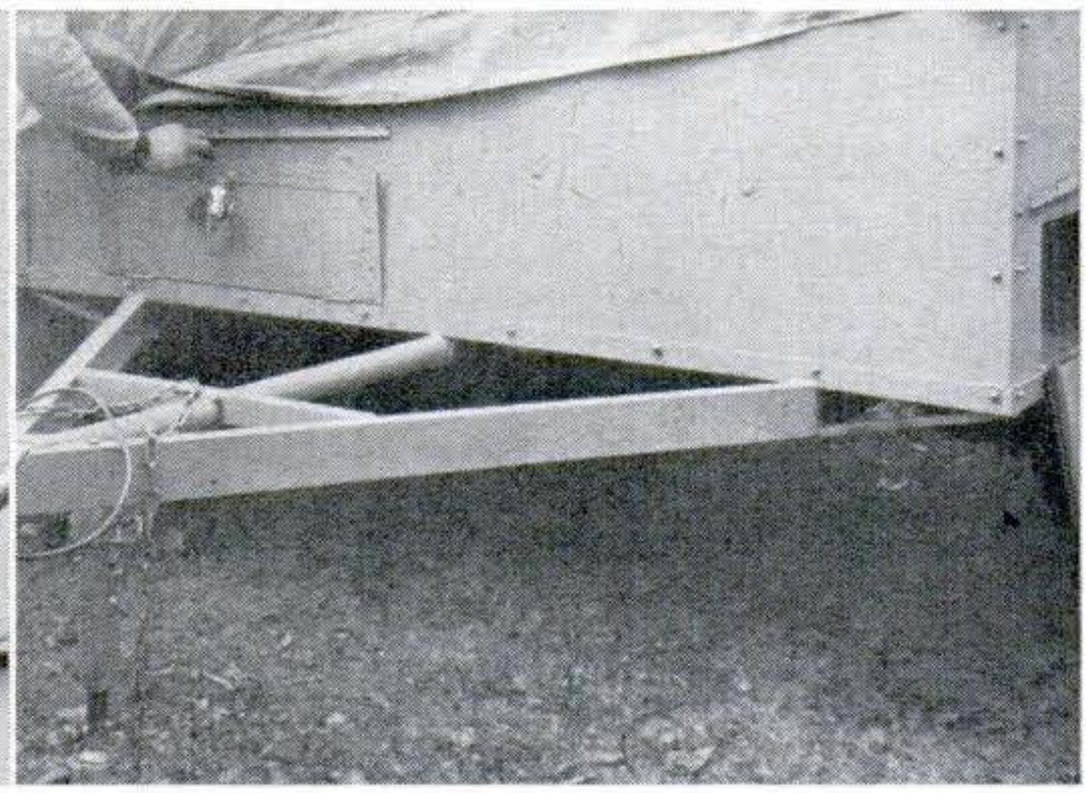
1:02. Over goes the top of the trailer box to become floor of the Moffetts' weekend home. This raises the attached tent simultaneously.



1:03. Junior Assistant in Charge of Snap Fasteners anchors down the one free side of the tent. This feature makes canvas stowing easy.



1:04. Inside the tent, Bob tugs on telescoping bow which draws the canvas taut. Pins, passed through the tubing, maintain tension.



1:05. With weather flaps smoothed over the box sides, the Moffetts' trailer tent is ready for service. What more could anyone want?

tains. That's living, say the Moffetts.

There's only one catch. These family-sized camping expeditions used to involve too much cargo handling. Tent, tools, sleeping bags, food, cookware, coats, hats, popguns! The car would be so full by the time the family was ready to leave that Bob practically had to grease the kids and wedge them into the back seat feet first. Travel, under these conditions, was a pretty rugged deal.

Setting it up. After cogitating a bit, Bob planned and built what amounts to a split-level, weekend home on wheels. When his wife sees a spot to camp somewhere along the highway, Bob can set up

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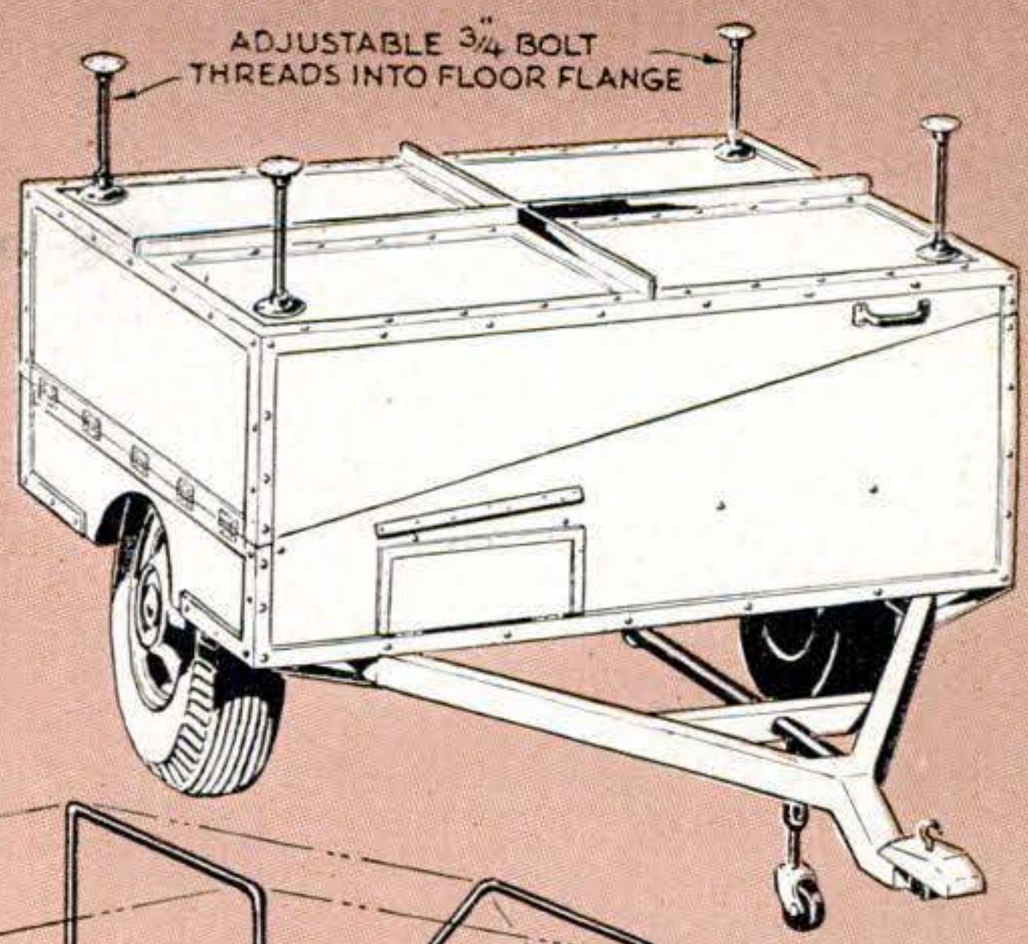
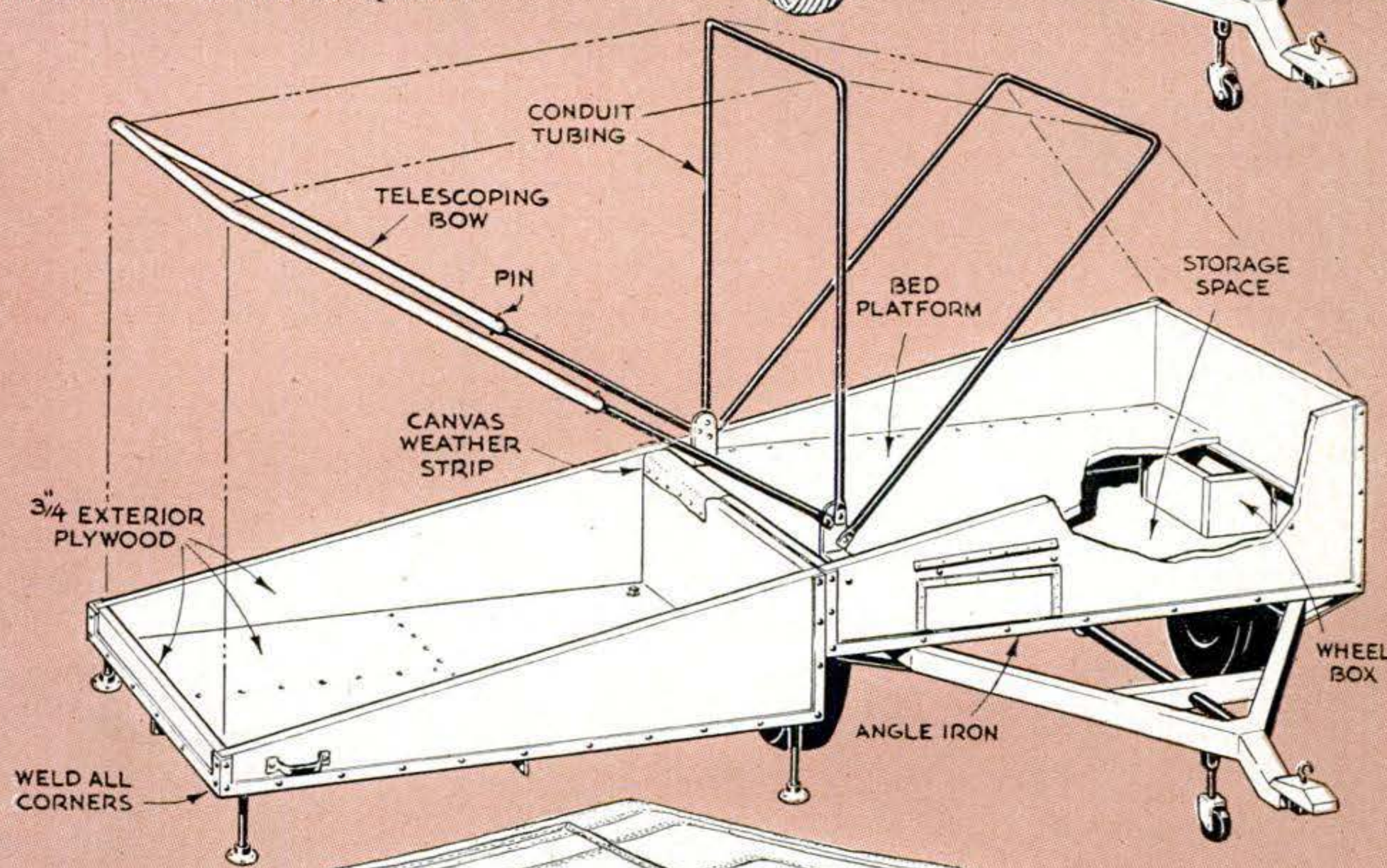
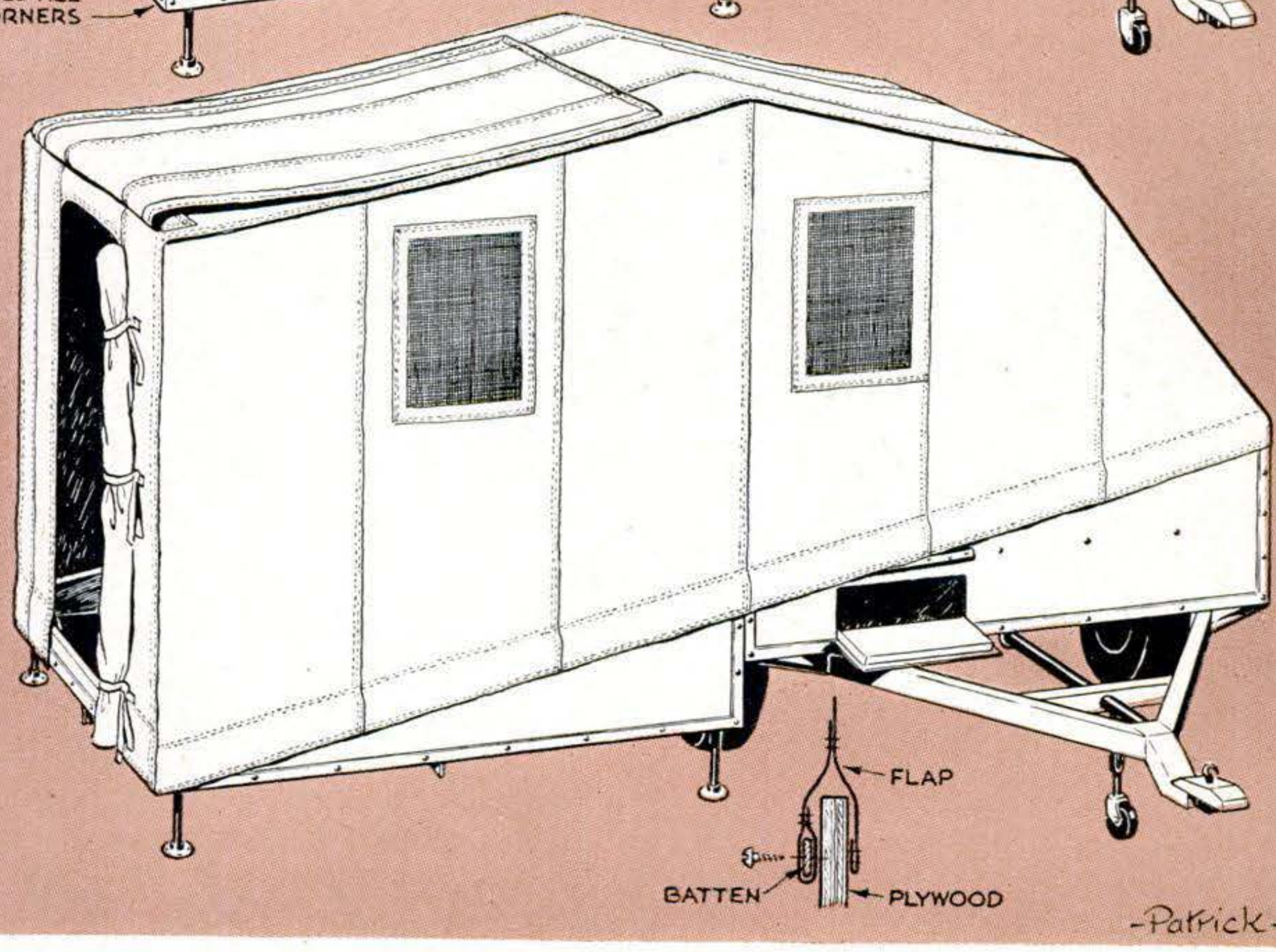
How trailer is designed to provide split-level living

FOLDED, as shown at right, the trailer box is 8′ long, 6′6″ wide, and 2′9″ high. Plywood sections are bolted to the angle-iron framing. The tent was tailored over the open box, with tubular bows extended and held in place by heavy twine (broken lines in drawing directly below). Four plastic-screened windows provide plenty of ventilation for the occupants.







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FOLDING CHAIRS AND TABLE, icebox, gasoline stove, food, cooking utensils, duffel bags—Bob has them all stashed away within reach of one or another of the trailer's four weather-stripped storage-compartment doors. Note the drip molds above them to shed rain water.

outdoor housekeeping faster than the sprouts can scamper out of earshot with their popguns.

He simply opens the two-section trailer box.

As the top section swings over on its hinges, out comes the canvas tent. And as the tent unfolds, three bows made from rigid conduit tubing pivot up to support it. Then Bob slides out the telescoping front bow to tighten the canvas. That's it!

Parlor and bedroom. Opened out, the two sections of the trailer body become the floor of the tent. The area just inside the door is roomy enough for indoor eating should the weather turn damp. Beyond, on the shelf covering the storage compartment, there's a full-size bed—mattress, covers and all—ready for sleeping in. George Pullman couldn't have done better.

Dimensions? It's pretty much a cut-and-fit proposition, Bob says. The body of his trailer turned out 8′ long (the

HERE'S THE PAYOFF at the end of another exciting day—a spacious platform above the storage compartment for comfortable beds. The beds are made up before the Moffetts leave home.

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length of standard plywood sheets), 6½″ wide and 33″ high.

Building the chassis. Bob could have bought a secondhand trailer chassis and gone on from there. Instead, he built his own chassis from structural steel and junked auto parts. He cut and welded two 3″ channels for bed rails, then set in heavy angle-steel crosspieces. For the axle, he scrounged a piece of tubing from an ancient car, cut it to length, and welded plates and front-wheel spindles to the ends. Leaf springs, which hang from shackles welded to the channels, carry the axle. Just for good measure, Bob bolted in a pair of shocks.

He found that the easiest way to build the body was to weld up the angle-steel framework first. Then he hacksawed it into two parts. This done, he could cut the plywood panels to fit inside the angles. Before bolting the body together, he cut openings for storage-compartment doors.

To throw some weight on the trailer hitch, Bob says, the trailer body should be mounted with its centerline one inch ahead at the axle.

The big top. Sewing together the tent proved the trickiest part of building the trailer. Bob could have used anything from plastic-impregnated fabric to close-woven nylon poplin. He settled for ordinary cotton duck, the least expensive.

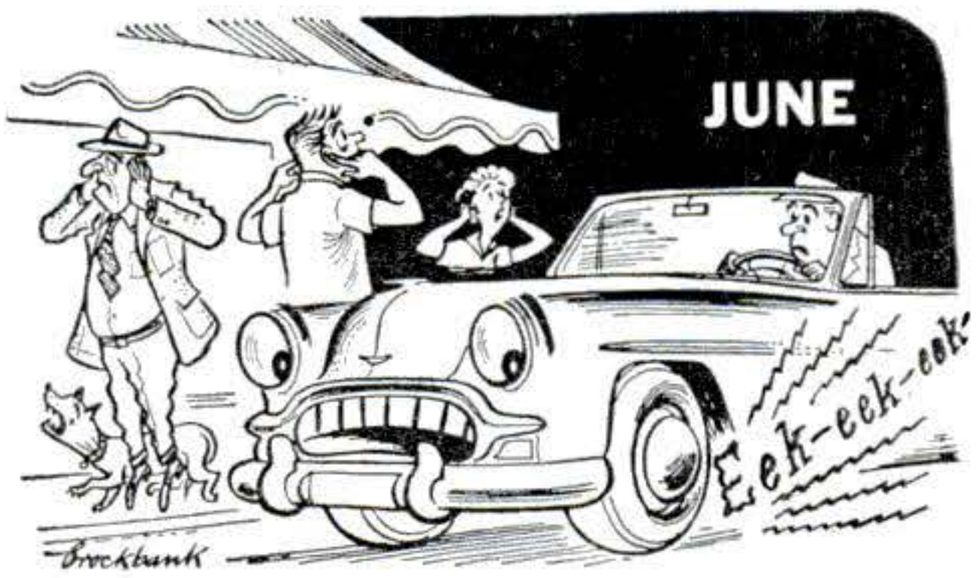
You'll never know how to sew a tent together until you've done it, Bob maintains. When you measure the trailer, raise the bows and tie them in position. Loop the canvas over them, pinning it temporarily, and then machine-stitch the seams. Worry about the details as you come to them.

That's about all the advice Bob has to offer anyone who wants to tackle this kind of a camping rig.

"Except," he adds, "a recommendation that you check your home state's licensing requirements before you hit the road. Oh, yes, if you should happen to see another trailer tent somewhere along the highway—one very much like yours—don't fail to wave 'Hello' to the Moffett family." END

ALMANAC
FOR MOTORISTS

Pithy proverbs, provident counsel and omens and portents of interest to horseless-carriage operators.



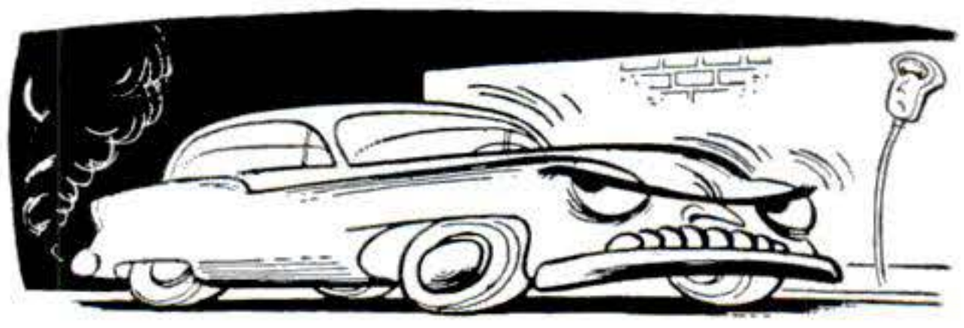
▶▶Front-wheel bearings need repacking in grease at intervals. They are easy to forget, but that doesn't mean they will let you ignore them indefinitely.

▶▶Says the Saturday-morning mechanic: "If you want to set the spark ahead or back a trifle, go ahead—it's a free country. But remember to regap the distributor points *first,* because that can change the timing."

▶▶Taking a long trip? One way to lick leg cramps and fatigue is to change the seat adjustment at least every 75 miles, forward or back. But take care you don't set it so close to the wheel that you lack the space to get your gas-pedal foot over to the brake in a split second in an emergency.

▶▶Know somebody who's cocky about his parking skill? If you can stage-manage a situation where he has to park a strange car in a tight spot, where the curb is curving and the car ahead isn't in snug, you'll wring the cockiness out of him.

▶▶On automatic-shift cars, the expert driver always moves the selector lever over to Neutral if he's going to stop for more than a few seconds. It's easier on the engine and a lot safer. A car that's idling in Drive is a cocked gun.



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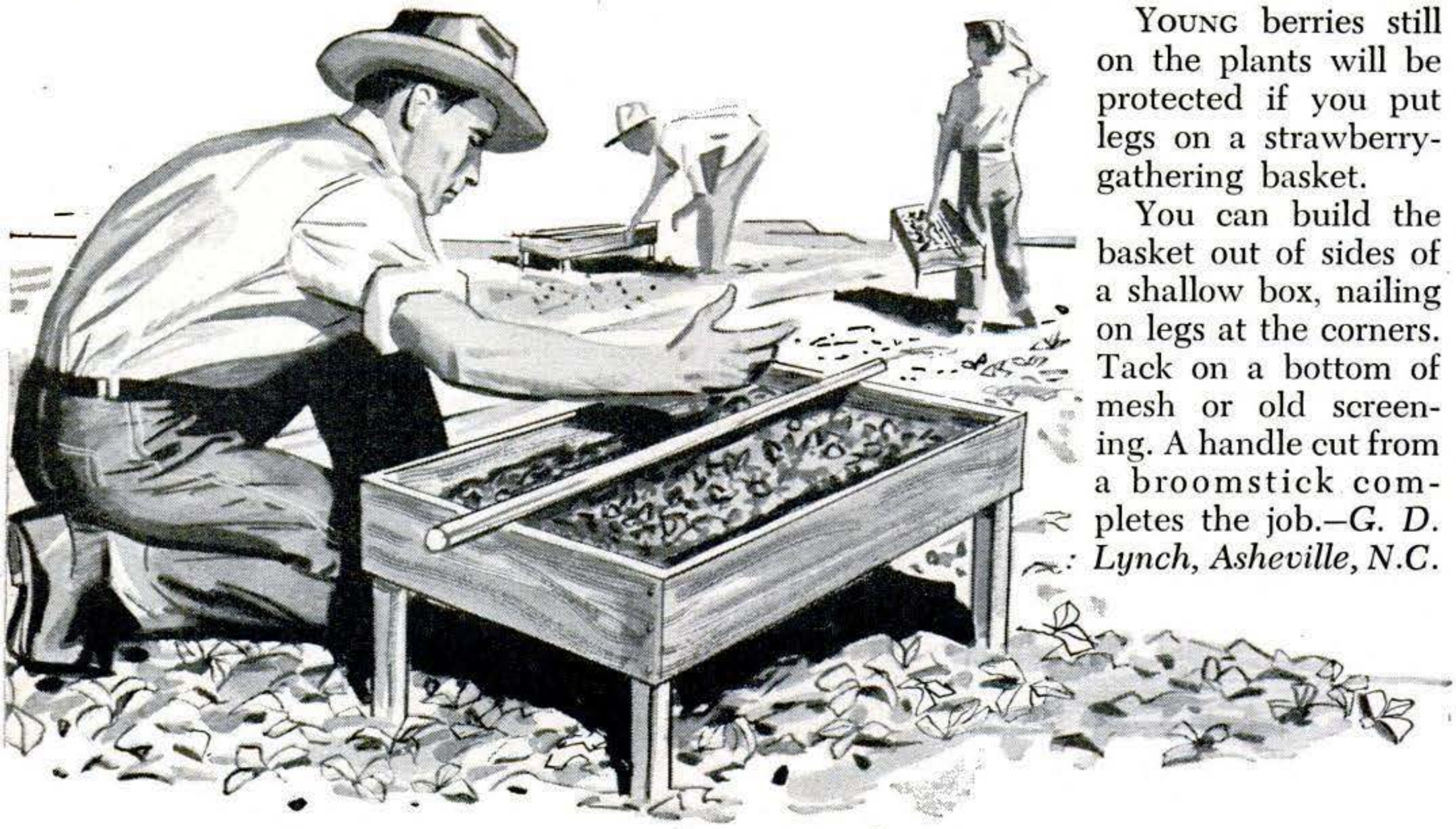
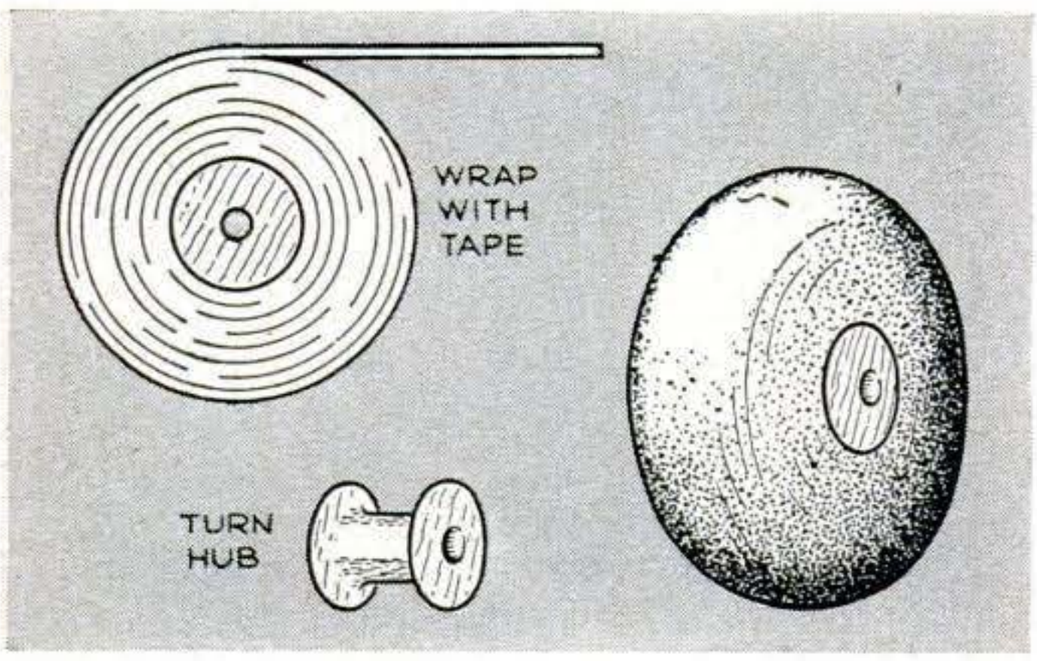
Legs on Strawberry Basket Prevent Crushing of Plants



YOUNG berries still on the plants will be protected if you put legs on a strawberry-gathering basket.

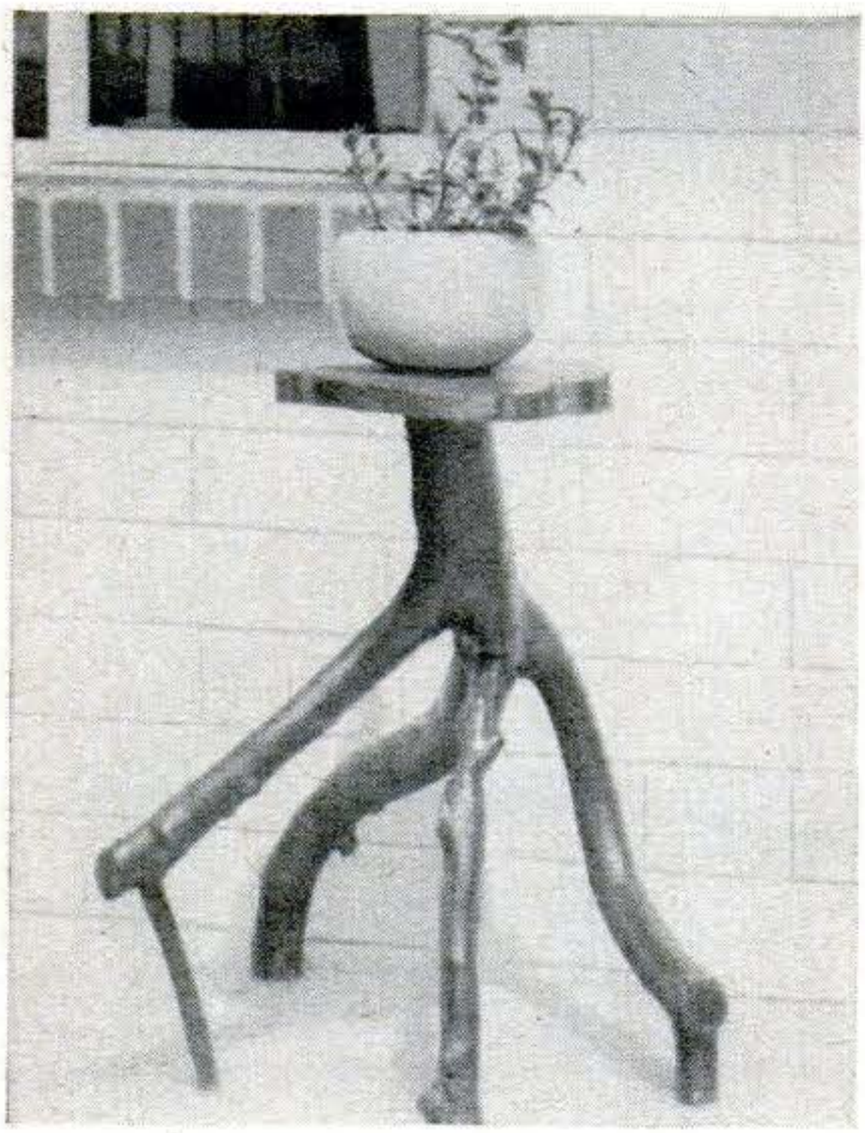
You can build the basket out of sides of a shallow box, nailing on legs at the corners. Tack on a bottom of mesh or old screening. A handle cut from a broomstick completes the job.—*G. D. Lynch, Asheville, N.C.*



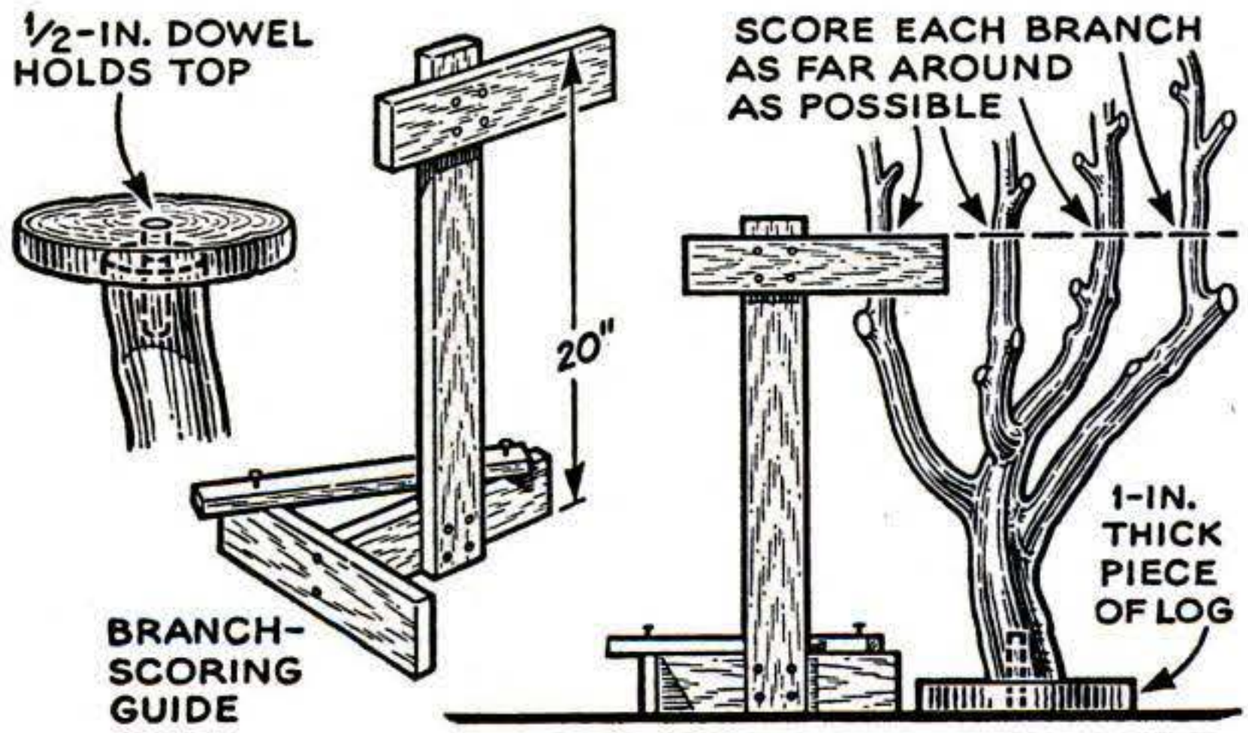
Model Tires Shaped from Tape

EXACT-SCALE fans who lack ready-made wheels for a project can make the right size with this method. Turn hardwood hubs, apply rubber cement and attach tires made of several layers of electrician's rubber tape. Chuck in a drill and shape with fine sandpaper or emery cloth, turning with the wrapping. Dust with talcum or coat with rubber-base enamel or top dressing.—*Roy L. Clough Jr., Bristol, N.H.*

Unusual Rustic Table Is Made from a Log and Limb of a Tree



A CROSS-SECTION slice of a log and a sturdy limb provide the makings of a rustic table. Select a limb with three or four strong branches for the legs. These can be sawed even by using a guide for marking the cuts. Protect the bark and top with shellac or other preservative.—*Hi Sibley, Nuevo, Calif.*



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ONE GOOD WAY:

Jack up the rear and push it sideways until wheels are out of the ruts. Then fill in ruts to prevent slipping back in. Spare wheel on ground will support the jack.

How to Get a Car Out of Beach Sand

By Scott Seegers

YOU can free a car from even the softest sand with just the tools that you usually carry and a little beachcombing to find scraps of driftwood.

I know, because I drove on a beach and deliberately got stuck—not once, but several times. Then I set up the photos that you see here, showing how I tried

THE WRONG WAY:

Once you are dug in, this is a waste of time and energy. Four or five men must heave in unison to get a car out of deep ruts by this back-breaking method.

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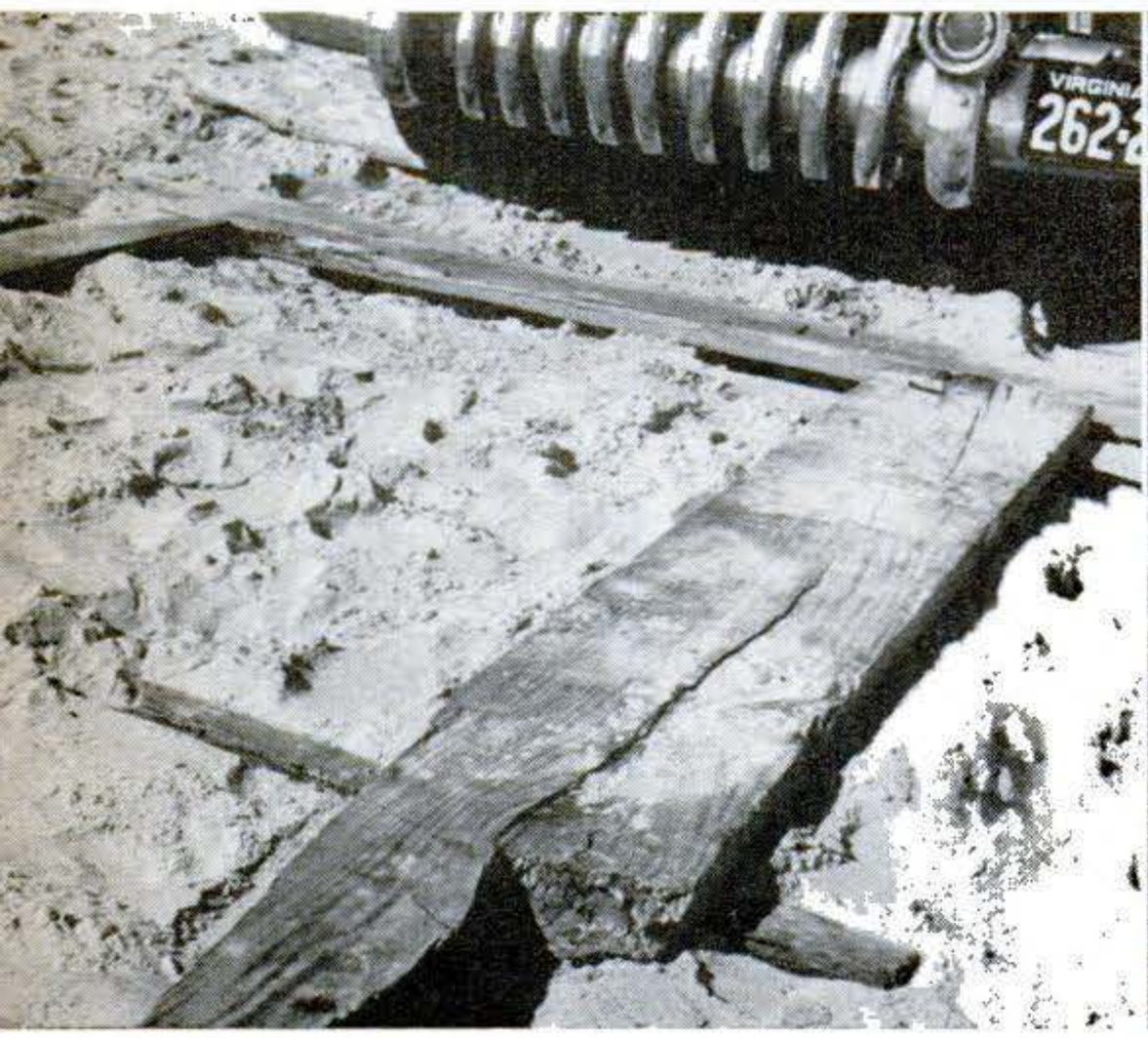
BEACHCOMBER METHOD: *Build a road of driftwood planks*

1 JACK UP CAR, resting base on heavy timber. As the wheel clears sand, fill in hole and slip plank underneath. Jack front wheels, too, if deeply in, or wedge plank against them.

2 LAY PLANKS CROSSWISE to car so they can't tilt and dump wheels into sand. Runway should start at rear wheels and extend at least one car length ahead to give sufficient start.



3 IF PLANKS ARE SCARCE, you can stretch supply by running some lengthwise, but rest ends on crosspieces to prevent tipping. Watch out for nails, and turn bad sides downward.

4 BLEED TIRES down to 10 or 12 pounds, or until they have squashed look, to give broader footing on sand. Ease car to a start, then gun it over planks and keep right on going.

several different ways of getting out.

All the methods worked fine. You can choose whichever best suits what you have with you and what you can find.

Building a road of planks. Here's where a wife and kids are the best tools that you can have.

Send them scouting for driftwood and have them collect as much as they can. The closer you space the boards and the longer the runway, the better chance you'll have of getting a flying start. Once moving, you can roll off the runway and onto the sand without the wheels bogging down.

Another method calls for a small block

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SAND-ANCHOR METHOD: *Block and tackle help haul you out*

1 ANCHOR FOR HOIST can be any heavy log or timber you can find. Bury it crosswise to car, 6″ below surface, and at least 25′ ahead to keep angle of rope as flat as possible.

2 FROM CENTER OF ANCHOR, dig upward-sloping trench toward car and lay tackle rope in it. If you use log, tie rope so pull is from bottom; if plank, tie it to center so it can't tip.

3 COVER OVER both timber and rope trench and tamp sand firmly down with feet. Use a short plank for a digger if you don't have a shovel. Rig tackle to bumper, long line to timber.

4 HEAVE HARD, AND SHE'S OUT. Once out of ruts, car may roll by itself. If not, keep shortening rope and, if needed, move anchor ahead. Double blocks will do; triples are easier.

and tackle, but it's a worth-while investment since it doesn't depend on finding planks on a beach where driftwood may be scarce. It will also work even in deep mud and quicksand where you may not be able to jack up your car first.

To give your tackle something to pull against, you literally throw out an anchor, by burying a timber in the sand, and tie your rope to that. By moving the anchor ahead after each hoist, you can hitch yourself any distance needed to reach solid ground.

Rocking may help. This is the easiest way of all and will usually work if you stop applying power the instant you feel

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SEVEN WAYS YOU CAN AVOID GETTING STUCK

PARK HEADED DOWNHILL if you can, or at least on the level. If you are caught with your car headed uphill, back down first to a flat area before attempting to start forward.

DON'T TRY TO TURN at low speed, and don't turn sharply at any speed. Angled front wheels dig in like a bulldozer.

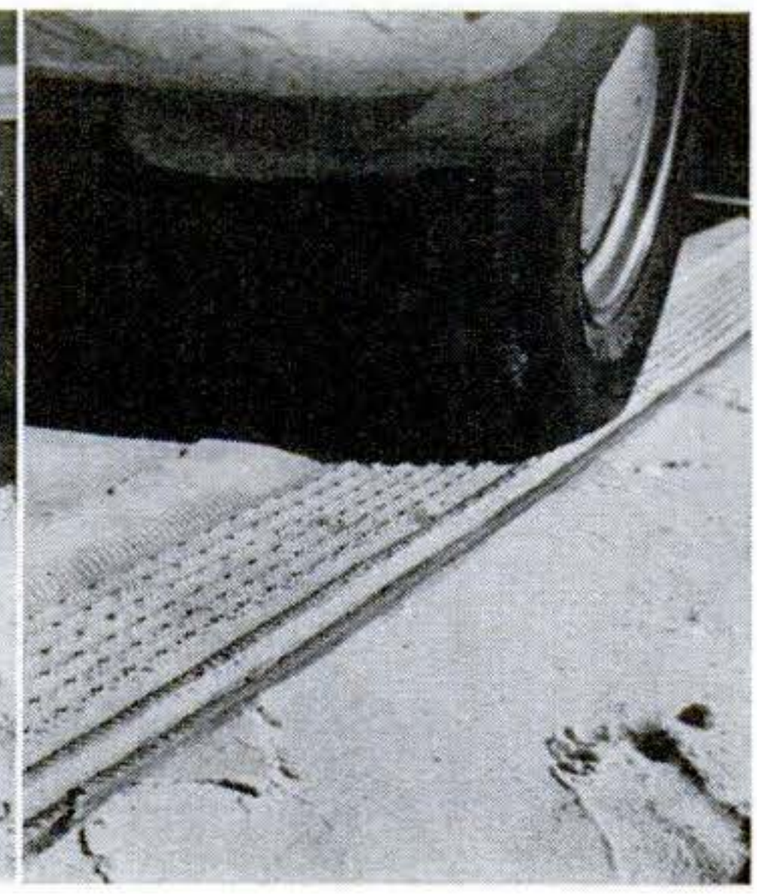
PACK A JACK AND SHOVEL along at all times. Still better, carry a rope and light block and tackle in your trunk.

STAY CLEAR OF WATER. The tide may come in before you can get out, and a car is never the same after a salt bath.

DON'T USE BRAKES in sand. The car below nosed in rim deep when braked at only eight m.p.h. Let car roll to a stop.

NEVER SPIN WHEELS. That just digs you in deeper. Heavy mud-snow treads will dig in even faster than smooth tires.

BLEED TIRES before you drive on beach. Note how flattened tire below widens tread area, scarcely digging into sand.



that the wheels are stuck, keeping them from digging in.

Apply just enough power to move the car forward a hair, then cut the power and let the wheels roll backward. At the exact end of the backward roll (it won't be more than 4″ or 5″), start to move forward again slightly. After four or five such rocking motions, going a little farther each time, your wheels should roll forward out of the depressions, and you can ease your car to traveling speed.

Whichever method you use, two things are important. Let the air out of your tires until they appear flattened before you even try to move. And once you do move, keep headed straight—even if it takes you farther onto the beach—until you get up speed. If close by, use the hard-packed tide strip to reach sufficient "planing speed" to stay "afloat."

Then turn in a wide arc toward the road and don't stop until you reach it. You can *walk* back to pick up the tools and the family. END

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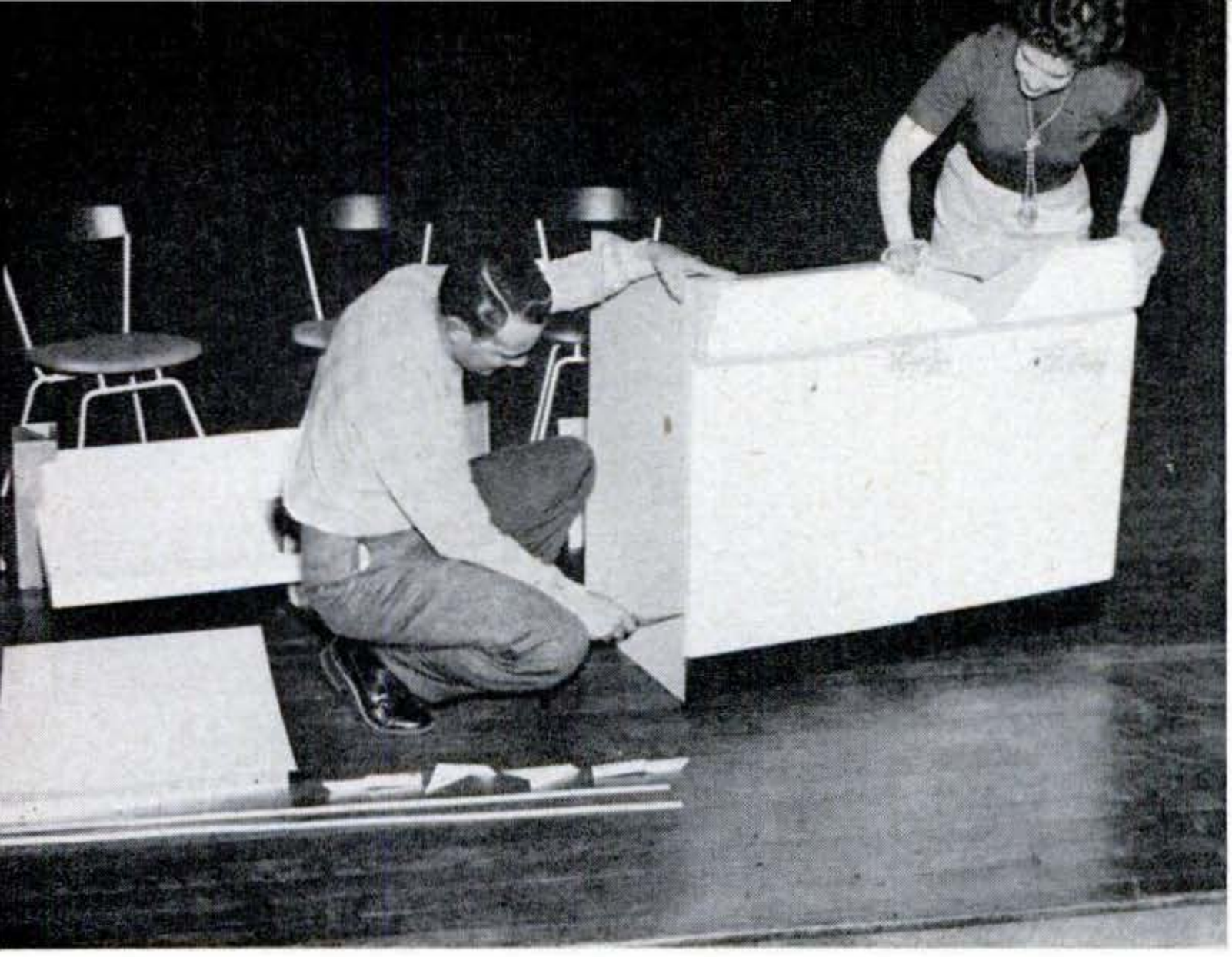
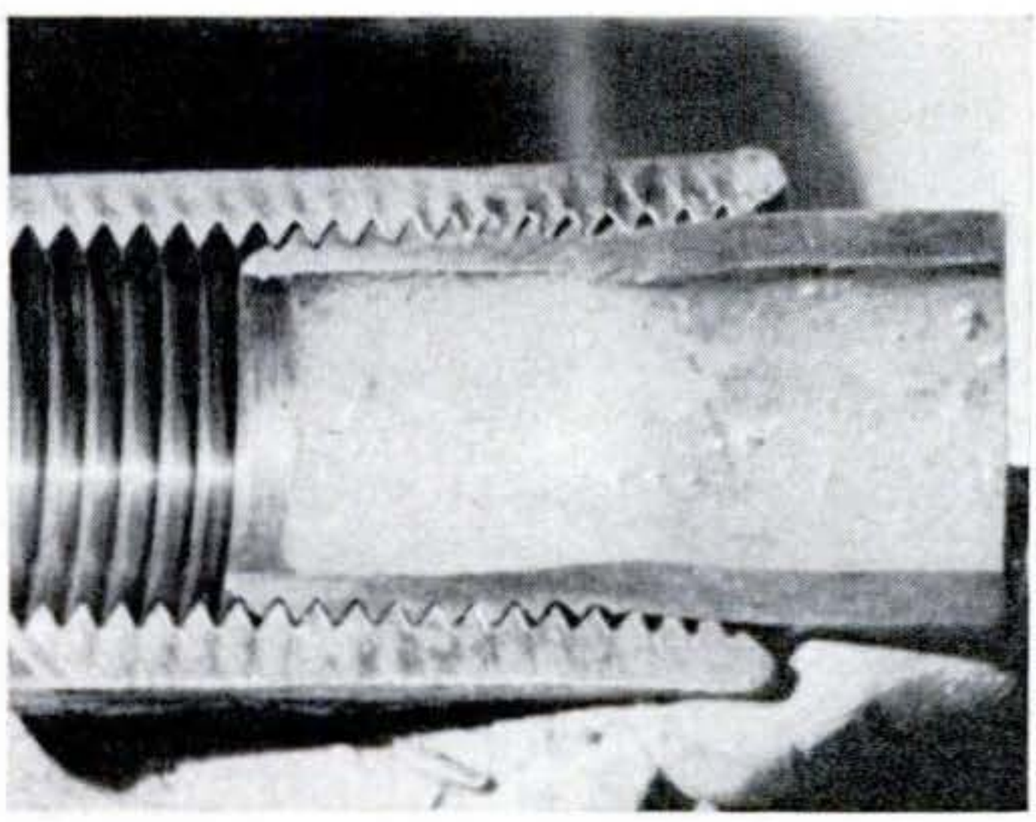


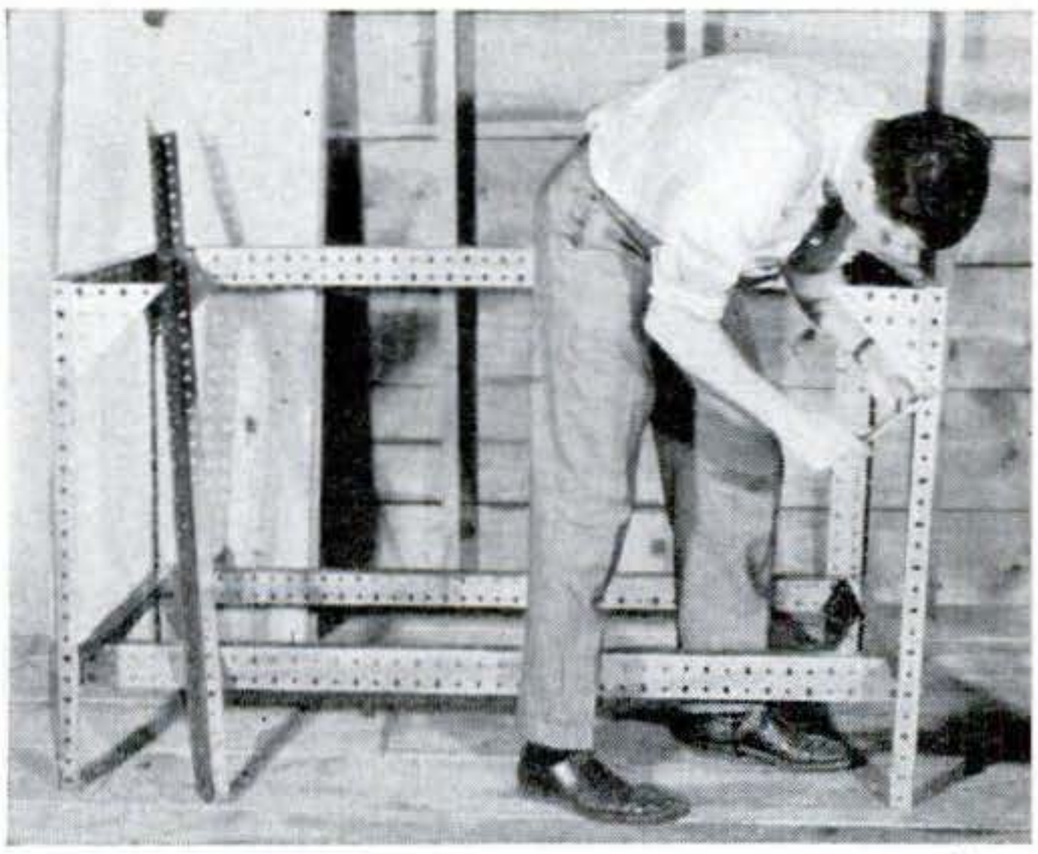
New for the Handy Man

1. Sink Comes in Kit. A new knockdown kitchen sink and cabinet (left) can be set up in minutes with screwdriver and pliers. It comes 42″ wide with a single bowl and right- or left-hand drainboard. Complete faucet and hardware are included.

2. Lubricant Helps Seal Joints. Pipe joints can be made tight without fillers or calking compounds. A new lubricant enables you to run a fitting past the coupling threads (below), making a pressure-tight seal. The fitting remains undamaged and can be unscrewed easily by hand.



Further information about the products described on this page can be obtained from: 1. American Kitchens Div., Avco Mfg. Corp., Connersville, Ind.; 2. The Lockrey Co., Southampton, N.Y.; 3. Structo System, Elyria, Ohio; 4. Central Machine Works, 1234 Central Ave. N.E., Minneapolis 13.

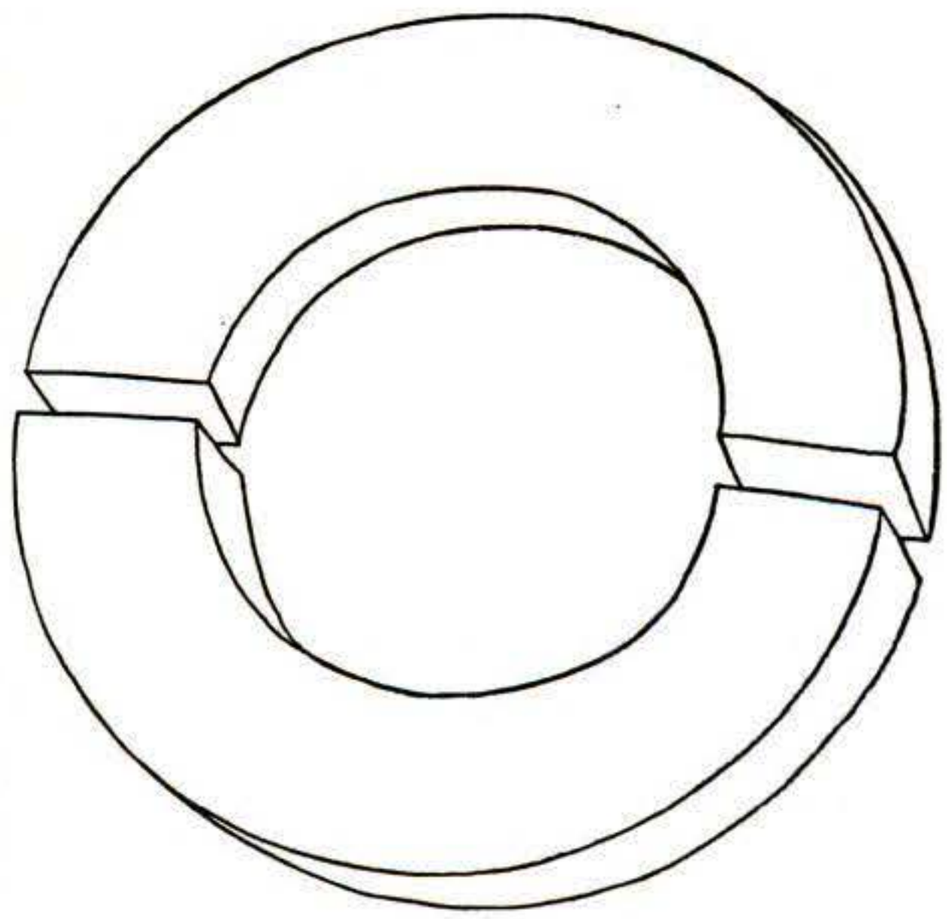


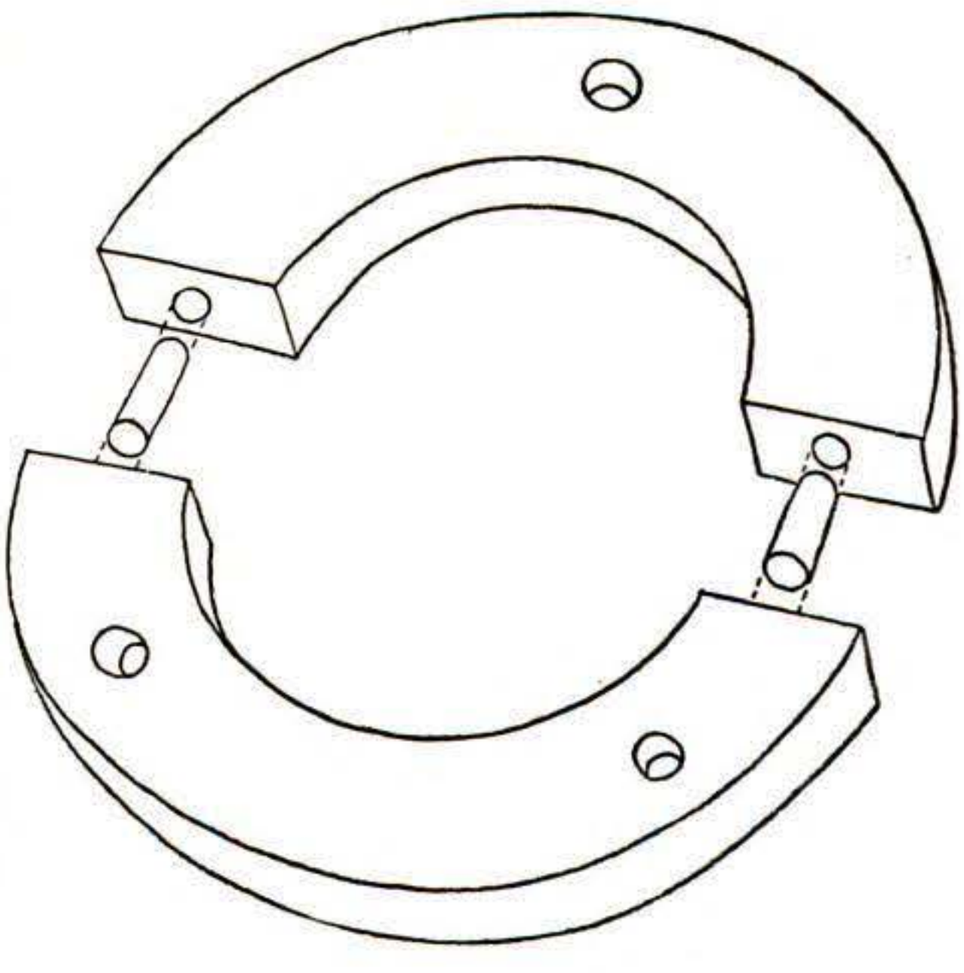
3. Angles Build Many Structures. These perforated metal angles go together like a toy construction set. You can make workbenches, racks, even small outdoor structures by hacksawing the pieces and bolting them together. A system of holes and slots insures matching bolt holes. The angles come in kits of ten 10′ lengths in 1½″-by-1½″ or 1½″-by-3″ sizes, and in 11, 12 or 14 gauges. You can also get a precut workbench kit, ready for assembly.

4. Float Brackets. Fastening steel drums to a diving float is easy with these metal brackets. Bolted to the float frame, they hook under the rims of the drums at the ends. Each pair of brackets will hold a 55-gallon drum.

By Roy Doty

Wordless Workshop





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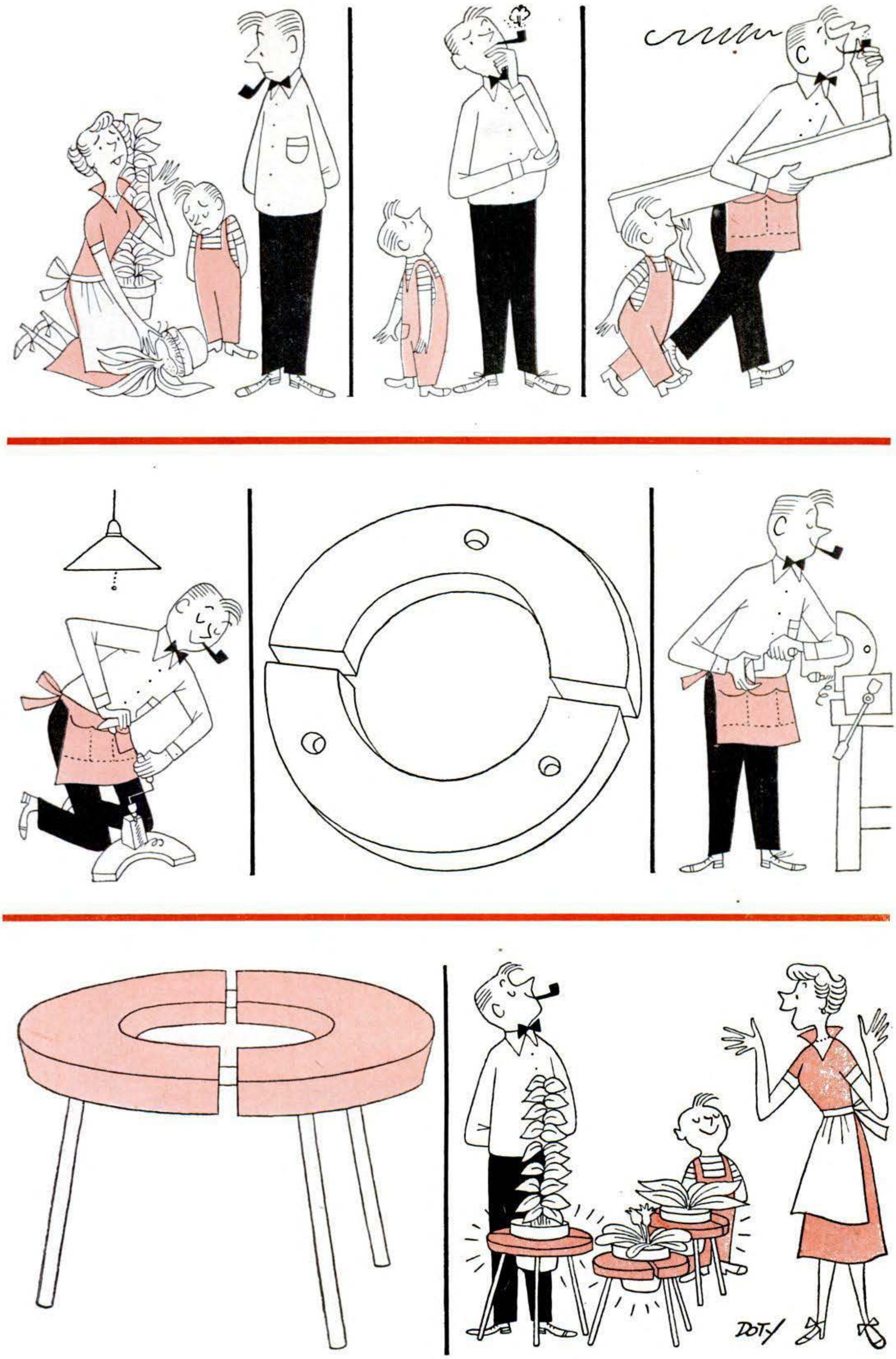

Like a pattern for this plant holder? Please turn the page

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A Pattern Makes the Job Easier

"WORDLESS WORKSHOP" projects can be built by experienced craftsmen without further instructions. But if you're a beginner, you might appreciate full-scale patterns. So the editors have made arrangements with the McCall Corp. to supply just such patterns for these projects.

To secure a full-size, iron-on pattern for the plant holders on pages 176-7, send 60 cents (50 cents for the pattern, 10 for handling charges) to Wordless Workshop, Popular Science Monthly, 353 Fourth Ave., New York 10, N.Y. Instructions are included. (See PSM next month for another pattern.)

Wordless Workshop, Dept. 655—107W
Popular Science Monthly
353 Fourth Avenue
New York 10, N.Y.

Please send me a full-scale transfer pattern for the plant holders. I enclose sixty (60) cents.

NAME_____

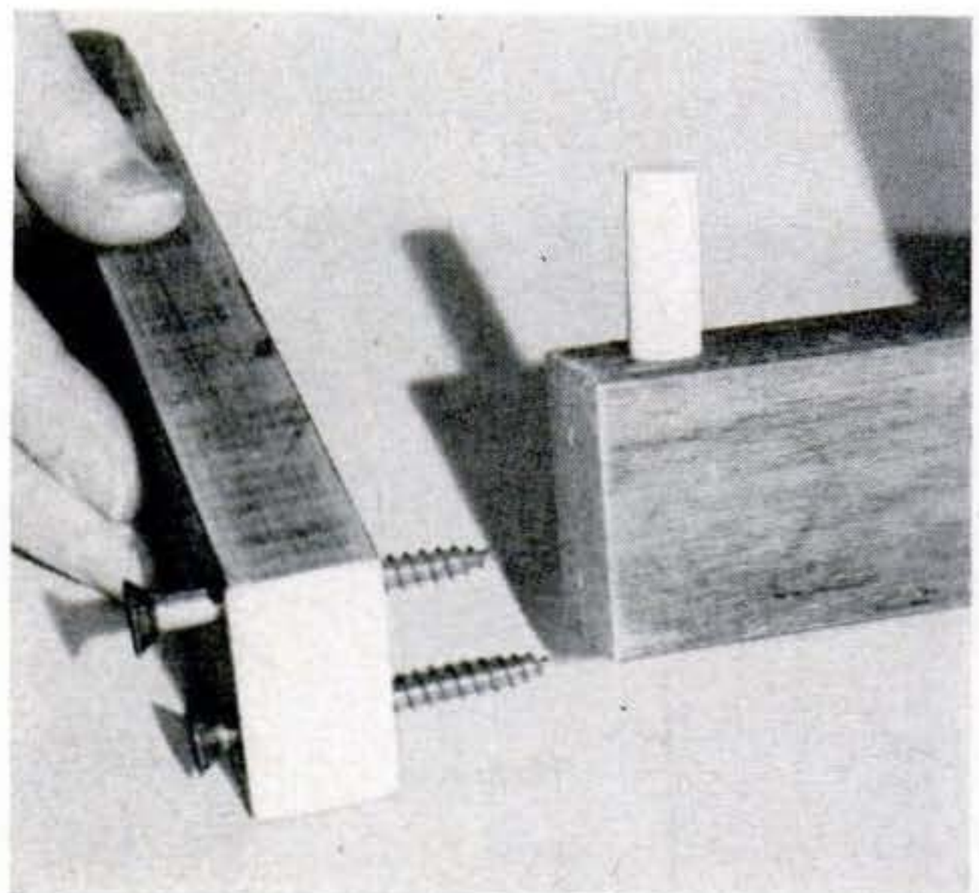
STREET & NUMBER_____

CITY & ZONE_____ **STATE**_____

Picture Frame Aids Typist

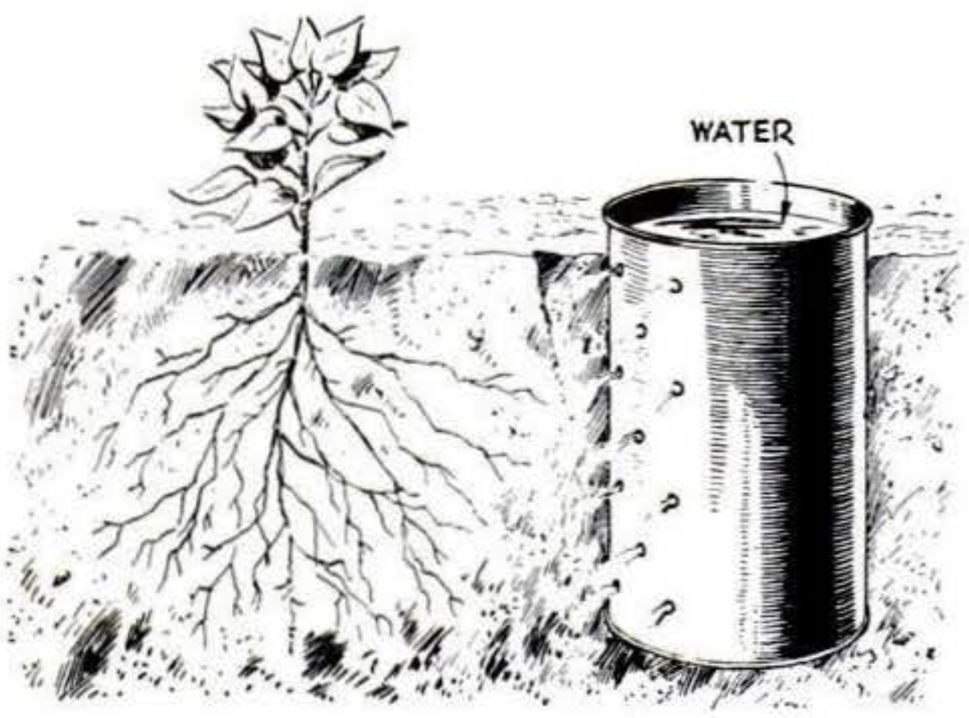
AN EASEL-TYPE or tilting portrait frame will double as a copyholder when you have a lot of typing to do. Any one in the house will serve if it's as large or larger than the original manuscript.

Slip a rubber band around the top of the frame to hold several pages at a time, and pull out each page from the bottom as you finish with it.—*Harry Nelson Webster, Nutley, N.J.*



Screws Anchored in End Grain

BECAUSE of shearing by the threads, screws rarely hold well in end grain. If you drill and insert a dowel across the grain, the threads will have an anchor.—*Frank A. Javor, North Bergen, N.J.*



Cans Moisten Plant Roots

HARD-TO-REACH roots of tomato plants, bulbs and rose bushes can be kept watered this way. Punch small holes down one side of a large fruit-juice can and sink it in the ground 6″ to 8″ from a plant. Water in the can will seep out, keeping the earth around the roots moist. —*G. Alison Raymond, Haverford, Pa.*

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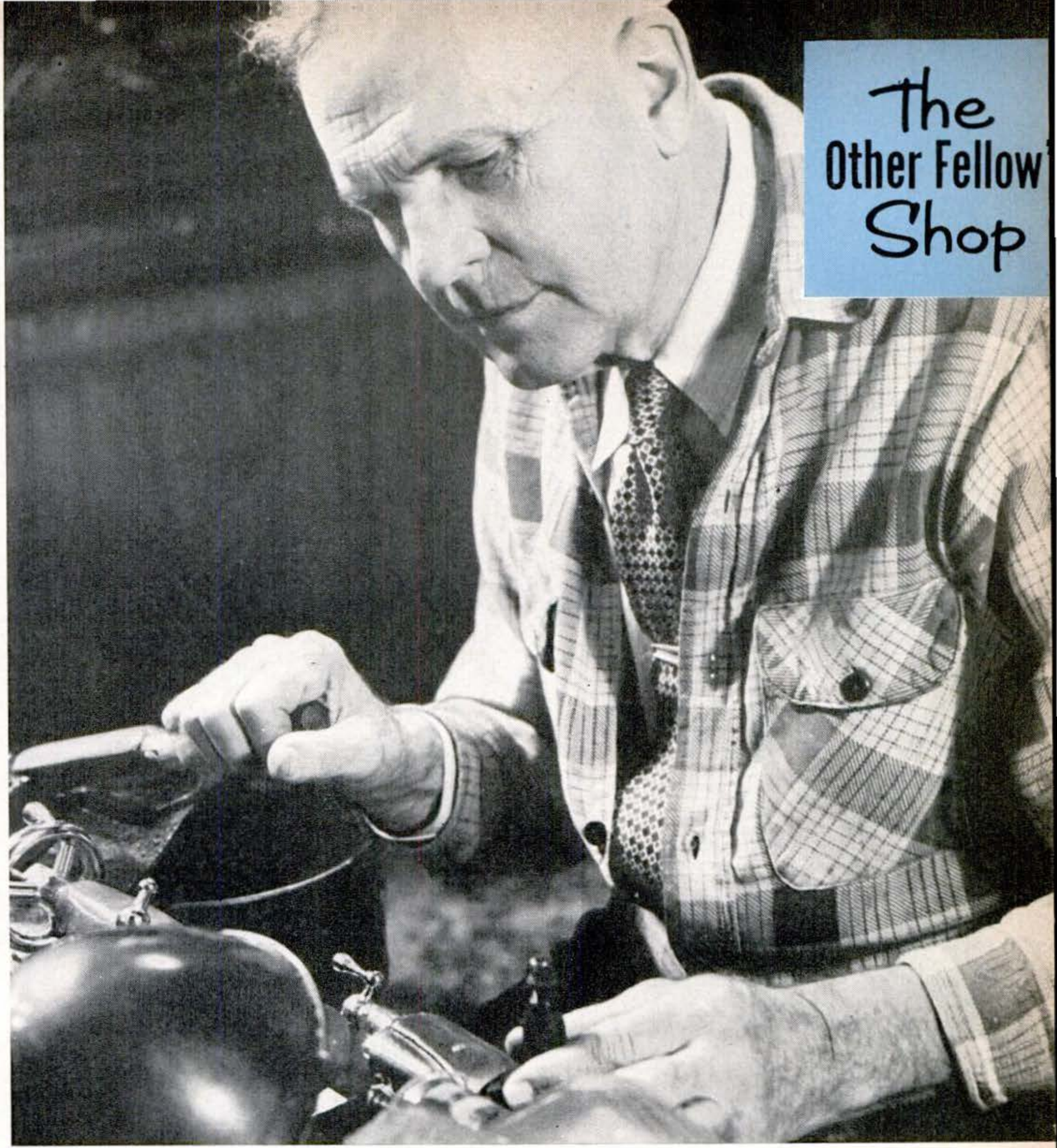

The Other Fellow's Shop

There's Big Business in His Basement

O. A. Olson turns out a thousand devices a day. Could you do it, too? Yes, he says. Here's how.

By Richard F. Trump

BASEMENT businessman O. A. Olson can tell you how to turn a home workshop into a full-scale factory. He's been doing it now for 36 years. First invent something that a lot of people need, he says. Check with a patent attorney,

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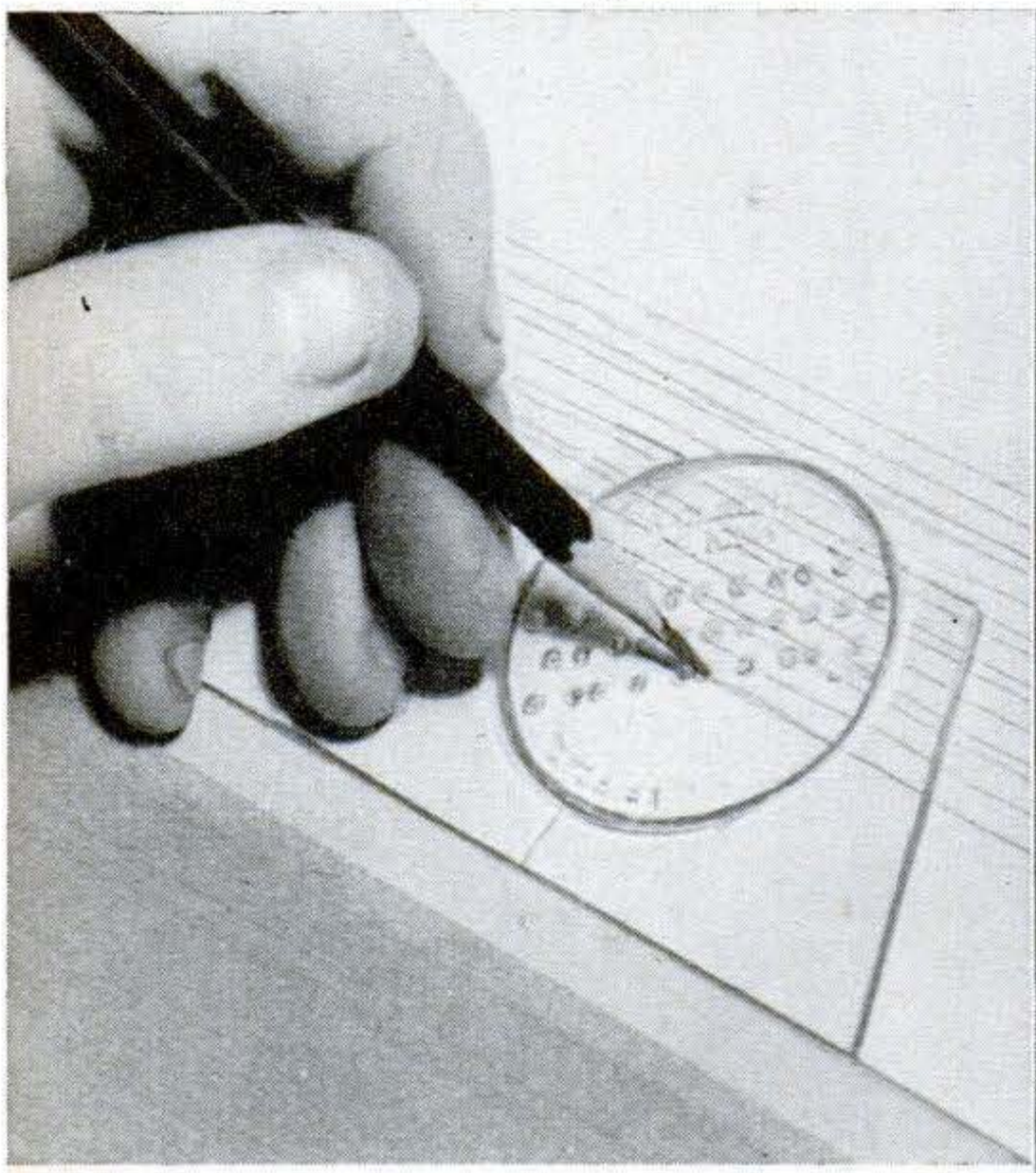
LETTERING INSTRUMENT has only two parts—a grooved plastic disk and a frame into which it snaps. Rotating the disk adjusts pencil holes for drawing variably spaced guide lines.



then watch constantly for ways to improve your product and simplify its production.

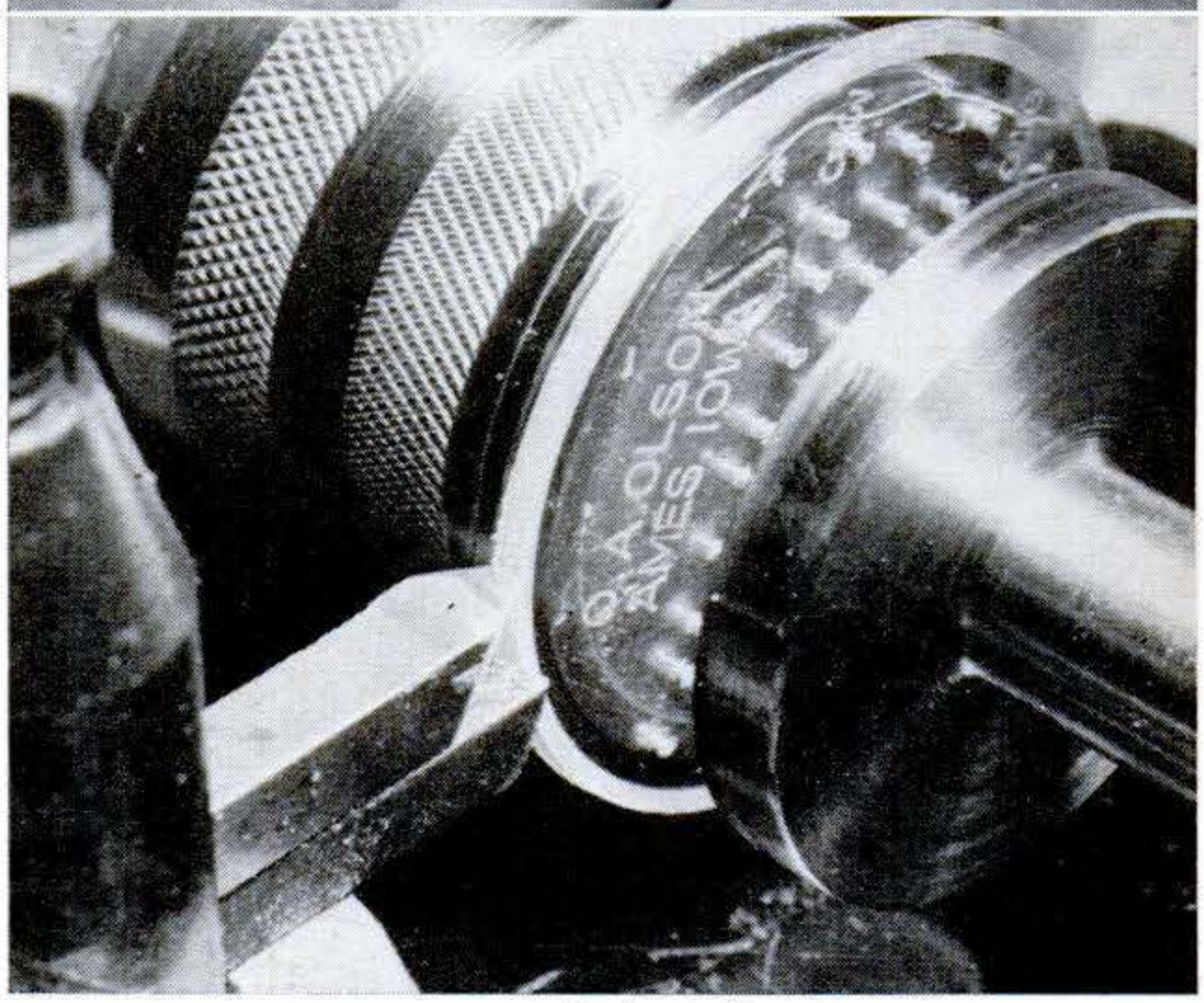
Olson's idea was a draftsman's guide for drawing parallel lines. He reasoned that on a part-time basis he could eventually make a thousand instruments a month. That was in 1919.

Today—still working in his basement at Ames, Iowa—Olson makes that many *daily*, with the help of engineering students working part time. And he is still finding better ways to do the job.

The money rolls in. How has it worked out financially? A few years ago, when Olson retired from Iowa State's engineering faculty, someone asked him that question. "I've had tough luck," he replied. "Flat tire on my wheelbarrow. That's bad. It's the only way I can haul my money to the bank!"

The "Ames Lettering Instrument" is a plastic disk containing small holes, mounted so that it can be rotated in a plastic frame. You insert your pencil in the proper hole and slide it across the paper against a T square, then change to another hole and slide it back, until you have a complete set of guide lines to

METAL JIG speeds drilling holes in plastic disks, but Olson isn't satisfied. He wants one that will drill two disks at a time. Previous attempt failed because the tiny bit bent.



QUICK-CHANGE SETUP on lathe edge-grooves each disk in seconds. Disk is simply slipped on pins in headstock and free-sliding tailstock is run up against it, eliminating fastening.

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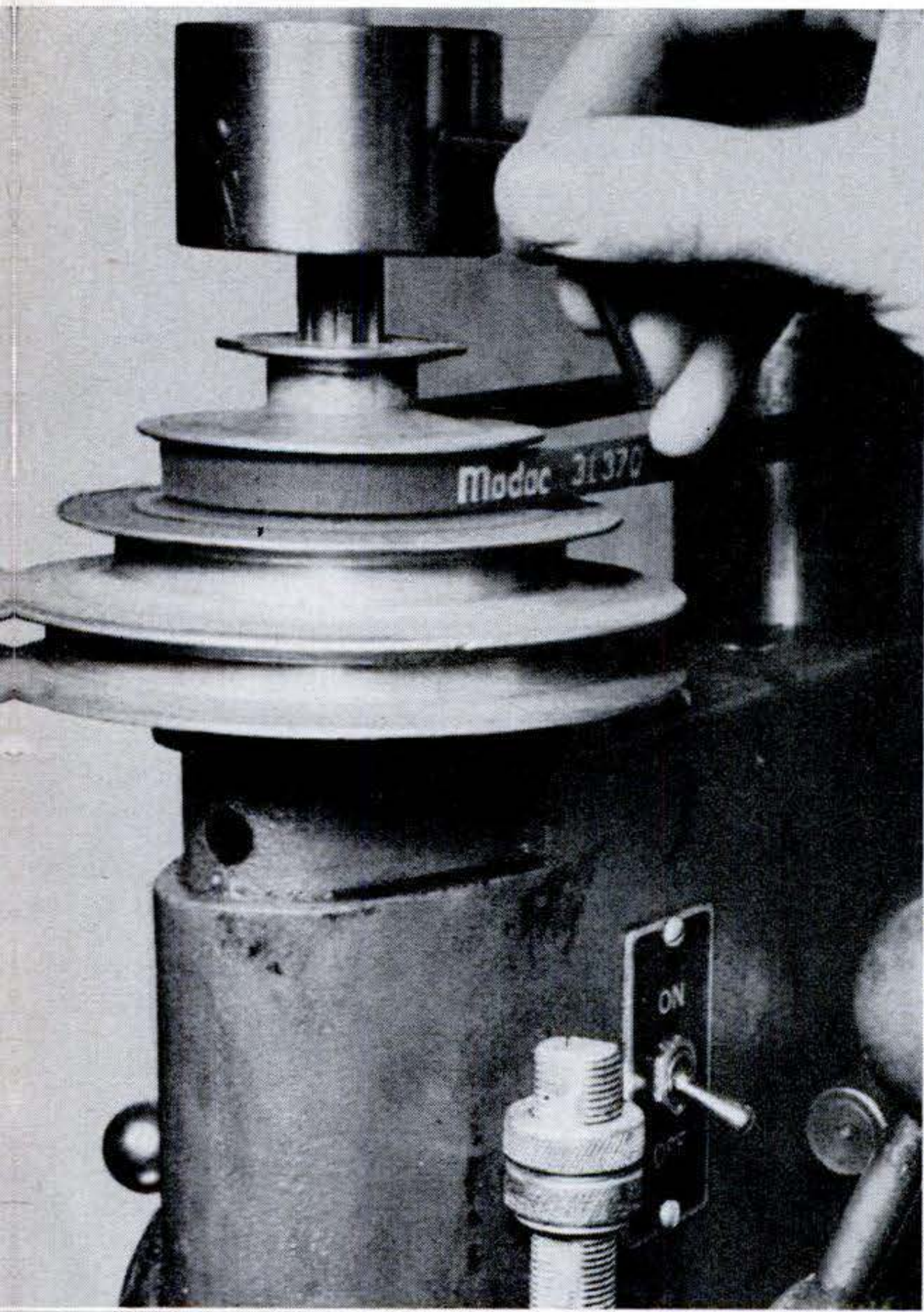
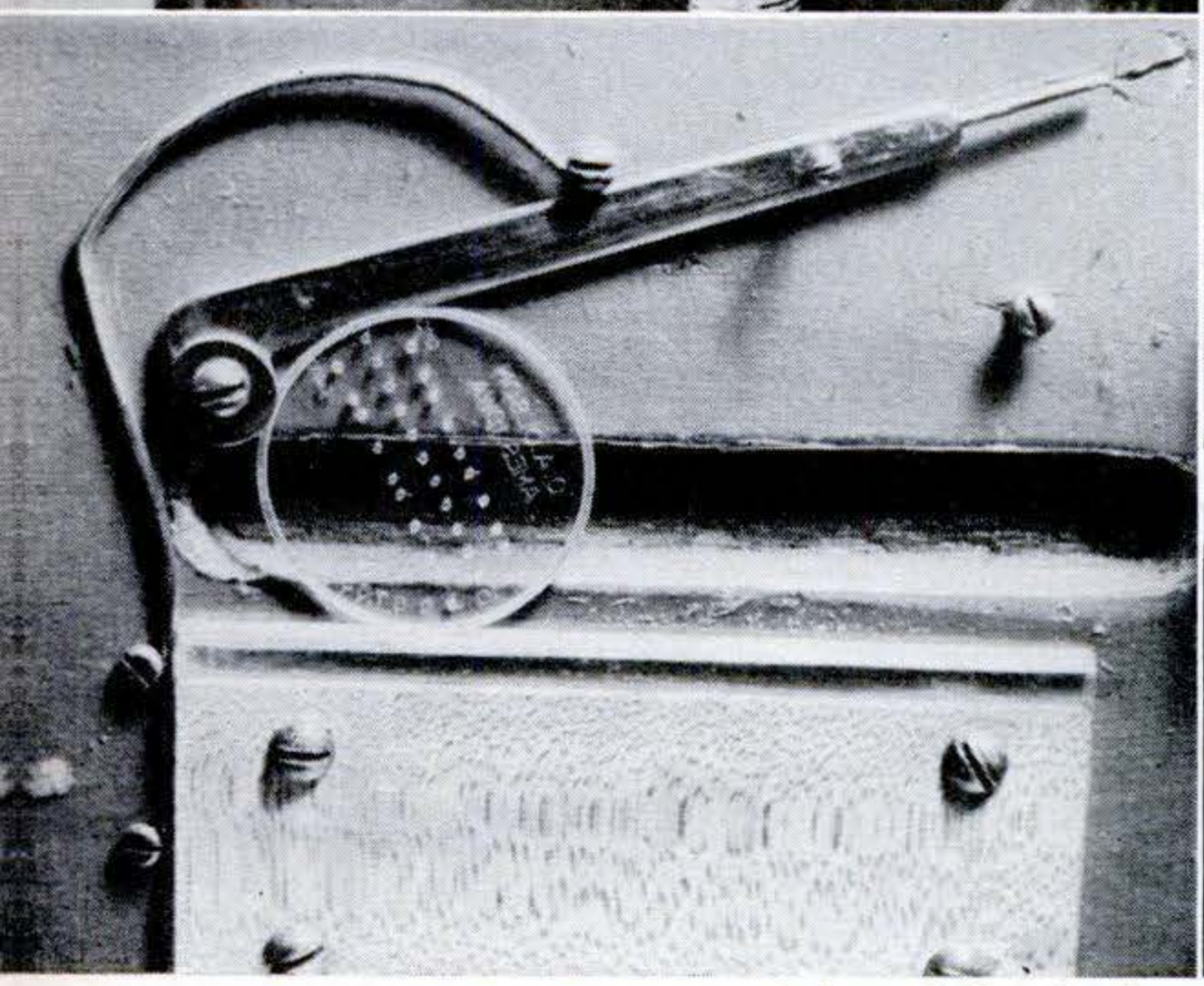
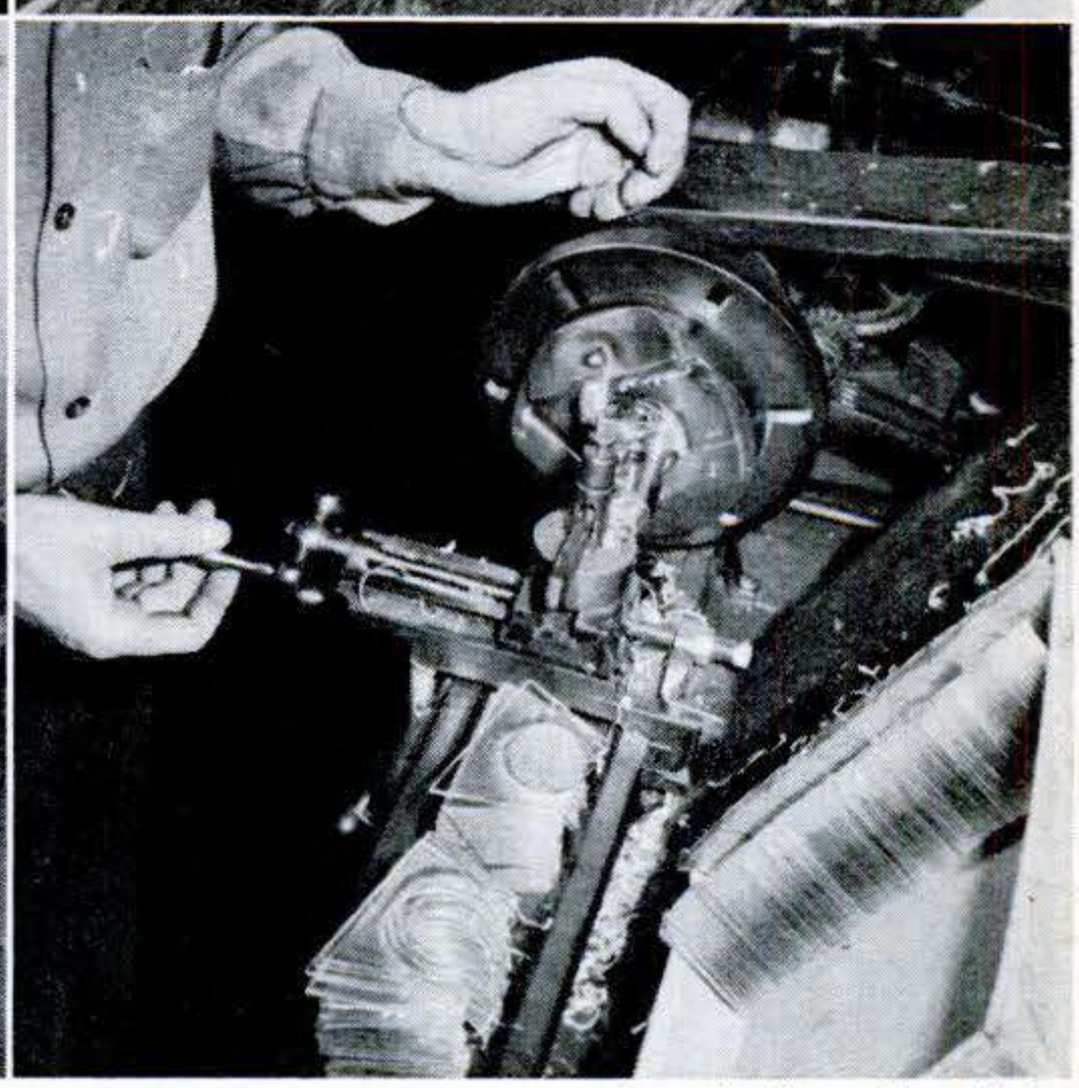
WHEN DRILL DEVELOPED SIDE PLAY because conventional depth stop was off-center, Olson put a stop collar on the spindle itself. Its in-line action gives wobble-free depth control.



FOOT-OPERATED PRESS stamps name and numbers into plastic disks. Student helper suggested beveling the edges of the die face, and now disks are handled faster and more easily.



HOMEMADE GAUGE mounted above lathe checks the depth of grooves periodically. When the pointer, spring-wedged against the disk, lines up with screw slot, lathe tool travel is correct.



STUDENT OPERATOR turns interlocking bevel inside frame opening, using cross-feed stop to gauge cut. With left hand, he works brake, permitting quick change of workpieces.

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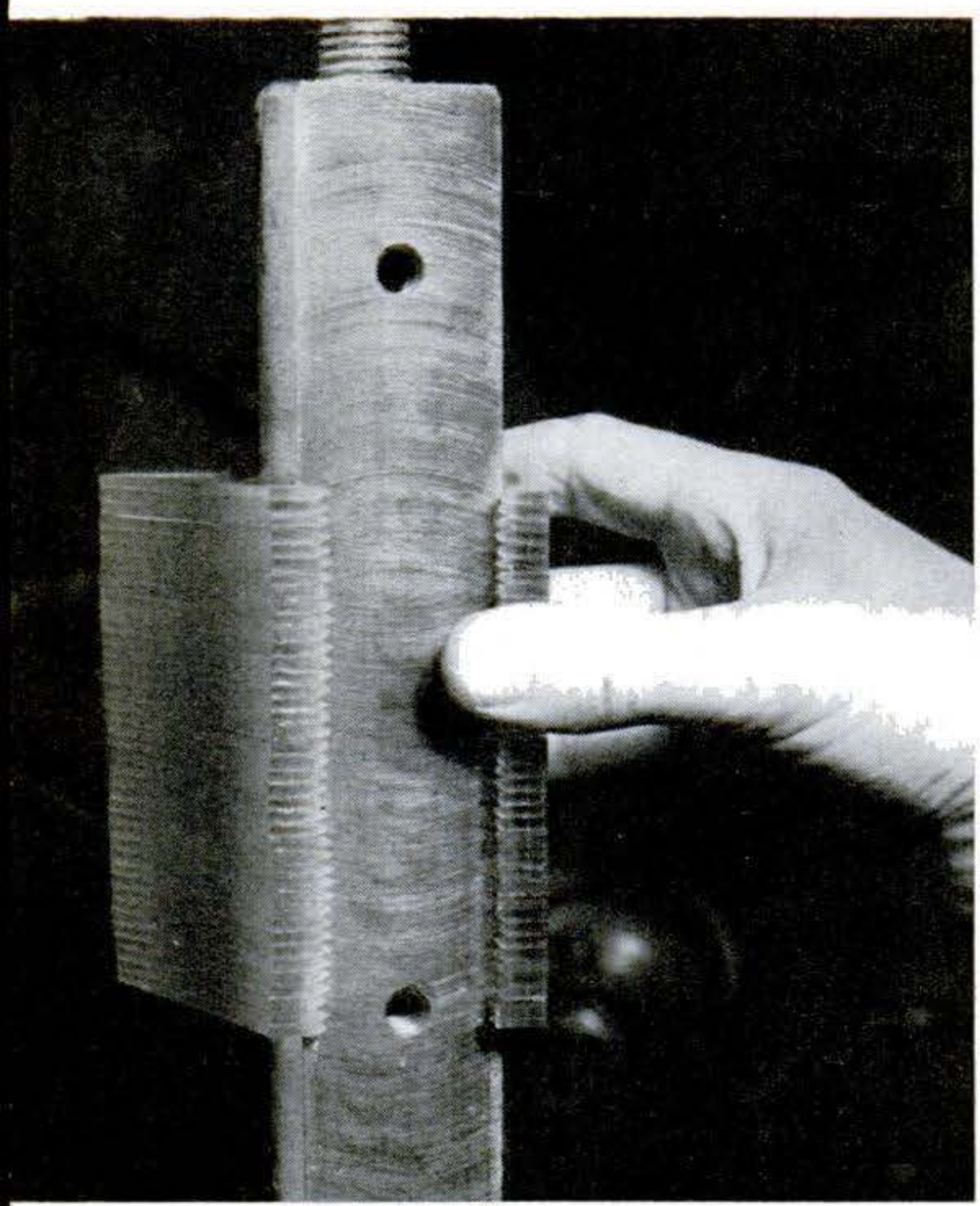

YOU HAVE TO WORK FAST, says Olson, to compete with big business. Here's a special mandrel he devised to hold 150 plastic frames for simultaneous finishing of their edges on jointer.

establish the proper height of various parts of letters.

By rotating the disk, you can change the proportions of the guide lines to fit any standard lettering style. The sides of the frame serve as guides for letters that slope. One side is for an angle of 68°, the other for 75°.

This is one of a series of articles about outstanding home workshops. See POPULAR SCIENCE MONTHLY *next issue for a story on another fellow's shop.*

How do you invent "something that a lot of people need"?

"You watch them work," says Olson. "You see ways of improving the things they have to do." There are plenty of workable kinks that have never been invented and a lot more that people have never carried beyond the daydreaming stage, he says.

Olson advises that you study carefully the devices that are already available for doing your job. There's no sense inventing a gadget that is inferior to something similar that is already on the market.

Legal advice pays off. While drawing up his original specifications, Olson described accurately the "steel frame" for his lettering device.

"What will you do when someone makes one from brass?" his attorney asked. "You'll have better protection if we call it a *resilient member.*" Years later, during the steel shortage of World War II, Olson converted to plastic. By periodically improving the design of his device and paying for skilled legal advice, he has been able to renew his patent at 17-year intervals.

Check list for inventors. If you think you're ready to take the plunge, Olson says that you should be able to answer all of the following questions with a definite *yes.*

1. Do you have enough capital to carry you over until the business shows adequate profit?
2. Do you believe in your product so firmly that you won't "fold up" if a distributor refuses to market it? Could you market it yourself?
3. If you can't use standard machines, are you prepared to pay for special ones?
4. Can your article be mass-produced? If not, will your customers pay the price of a custom-made item?
5. Will shipping costs be reasonable? If not, can you use lighter materials?
6. Is your source of power reasonable and reliable? Also your raw materials?
7. Will there be a long-range demand for your invention?
8. Have you visited a number of successfully operating small plants to see how things are done?

It may be a long time before you'll need a wheelbarrow for banking your profits. But the world has an enormous appetite for things that make life easier or more interesting. There's a bright future for anyone who can help satisfy that appetite. END

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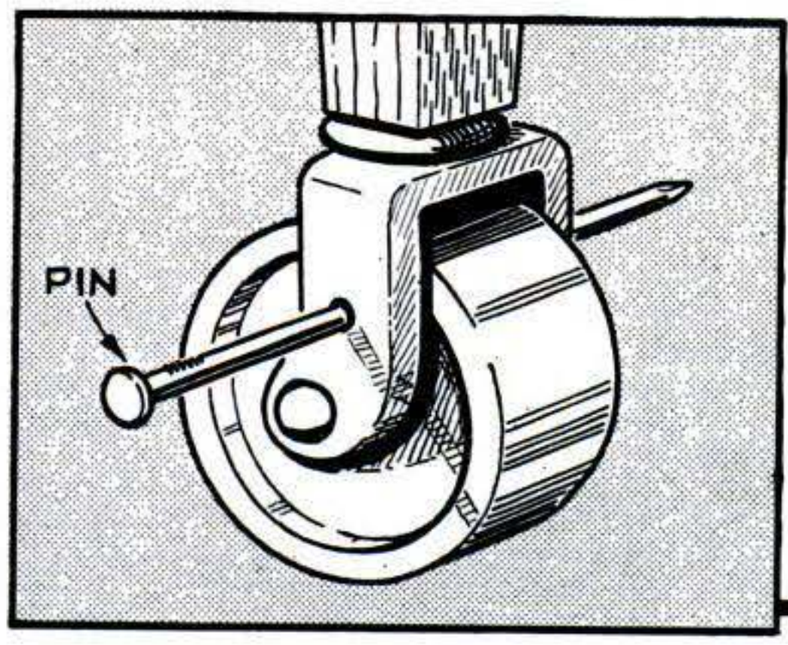
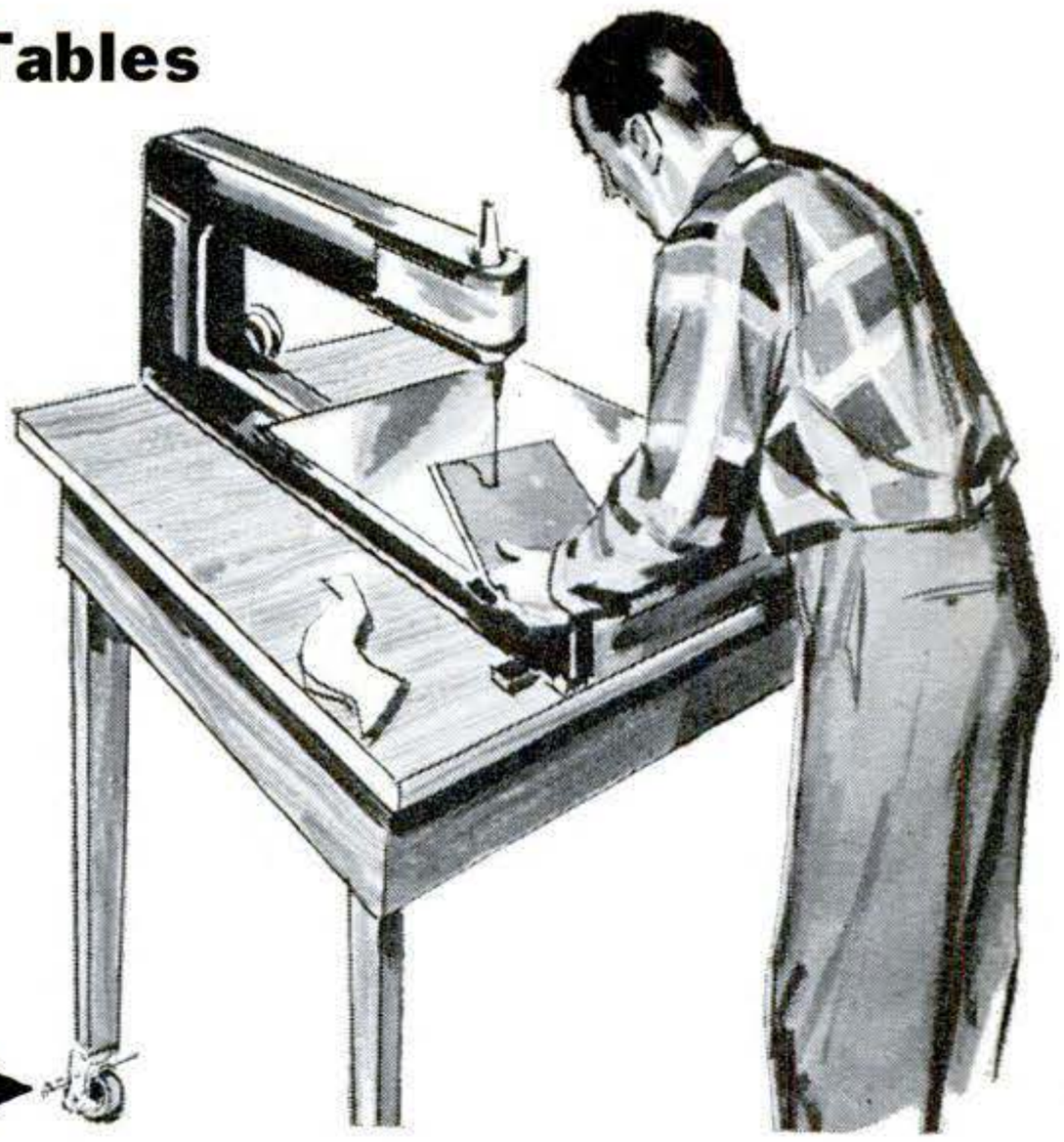
Wheel Pins Lock Power-Tool Tables

POWER-TOOL stands equipped with wheels can be locked to prevent creeping by drilling small holes through the wheel assemblies on the rear legs. Insert nails in the holes whenever you use the tool. *—J. J. Brahan, Pacoima, Calif.*

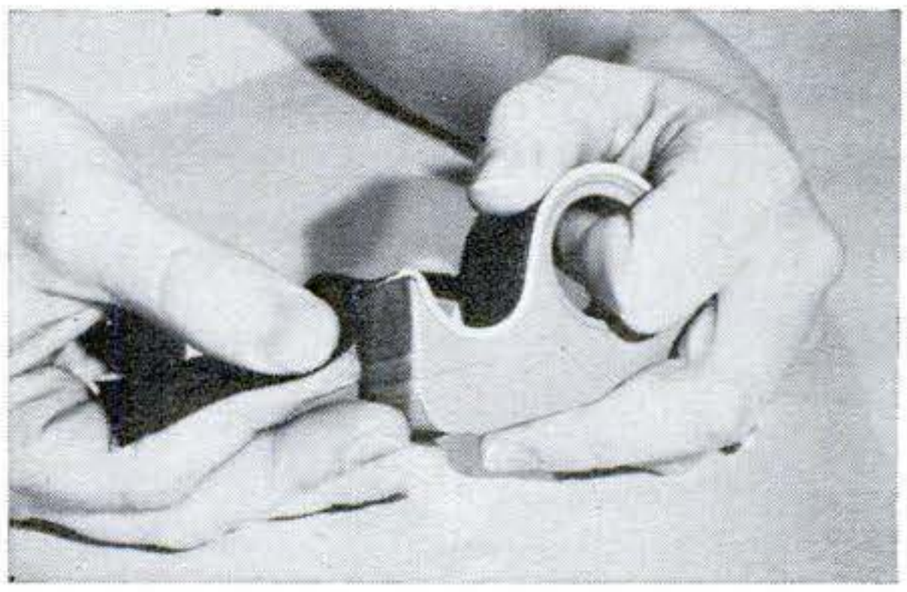


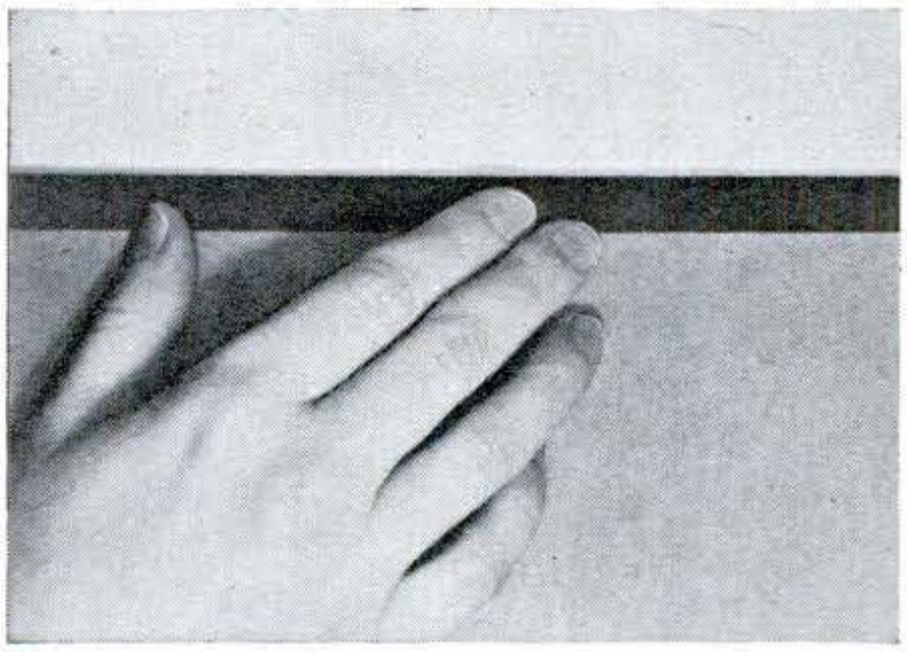


DO IT THE EASY WAY

STRETCH TWO C CLAMPS to span a greater distance than either will alone by hooking their ends together and using them in tandem like this.

CUTTING ELECTRICIAN'S TAPE is a cinch if you mount the roll in a discarded cellulose-tape dispenser. Then just tear off the length you need.





A NEAT FEATURE STRIP to separate two wall tones can be made by painting a length of half-round molding and tacking it to the previously painted wall.

THREADING A ROPE through small openings will go more quickly if you first dip the end in shellac. Let this needle dry for a day before you use it.

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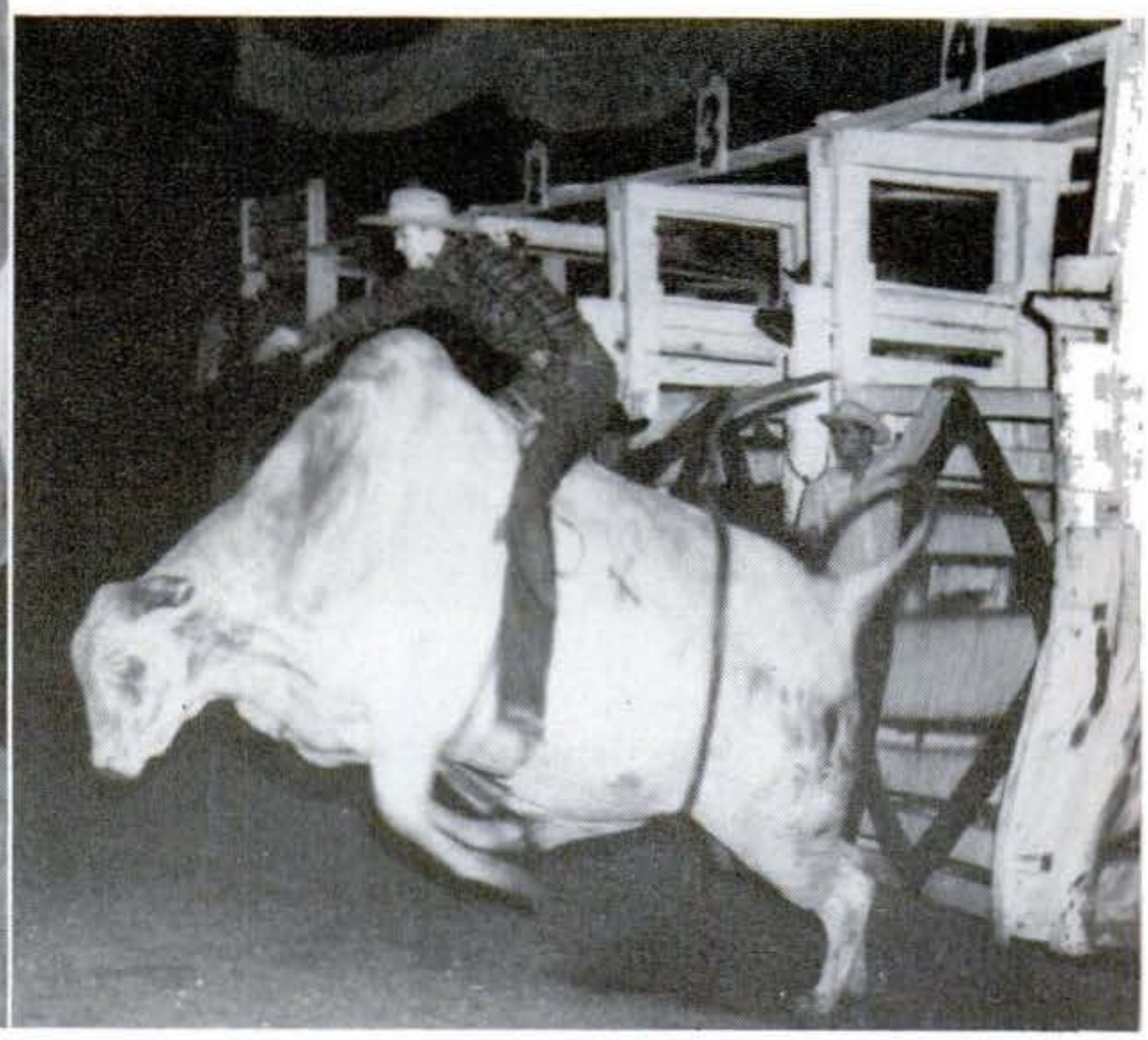
Using any camera, you can

Amuse Your Friends with Crazy-House Pictures

Photos by Weegee

A modernistic painting? Nope. Just a photo.

Know any real good shaggy-dog stories?



A bucking bovine, or steer with a hump on.

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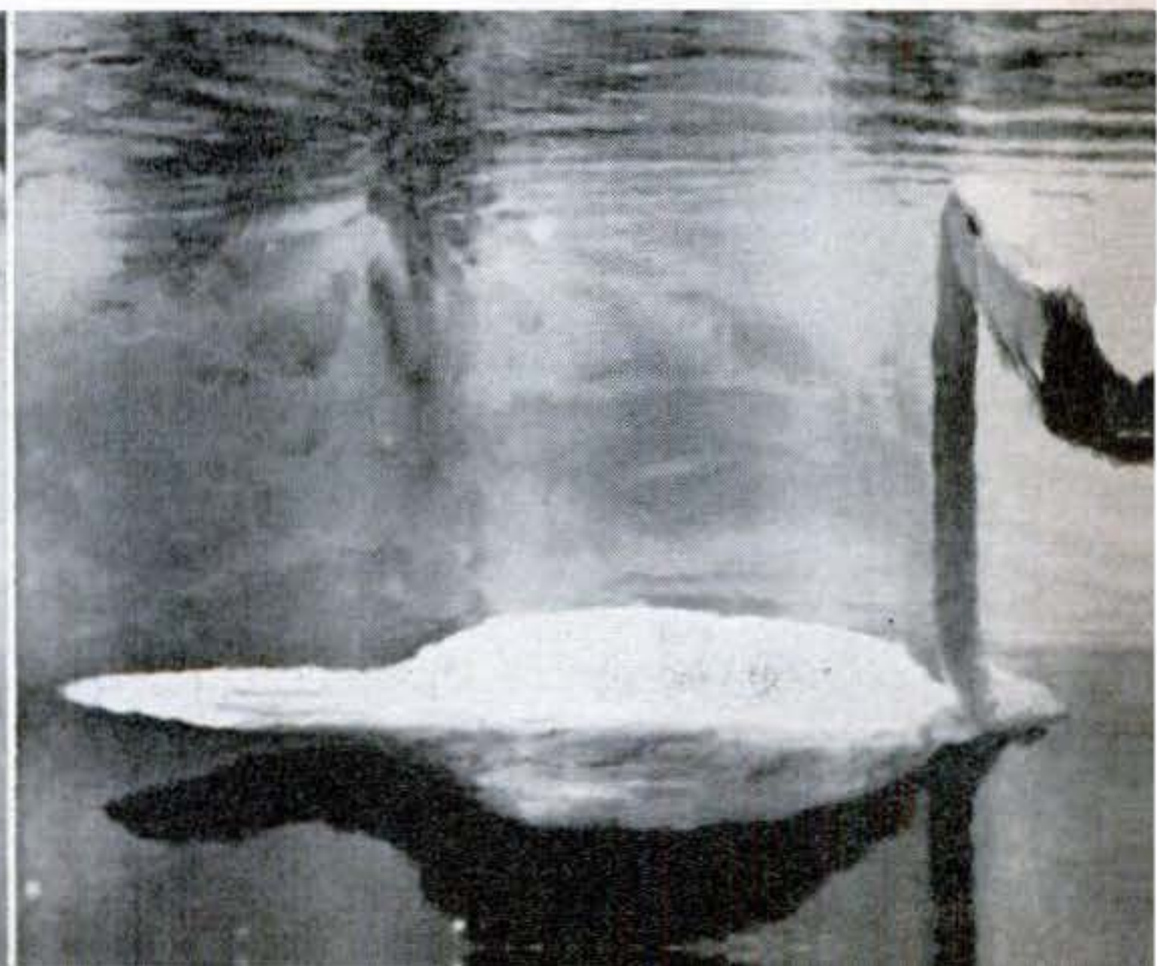
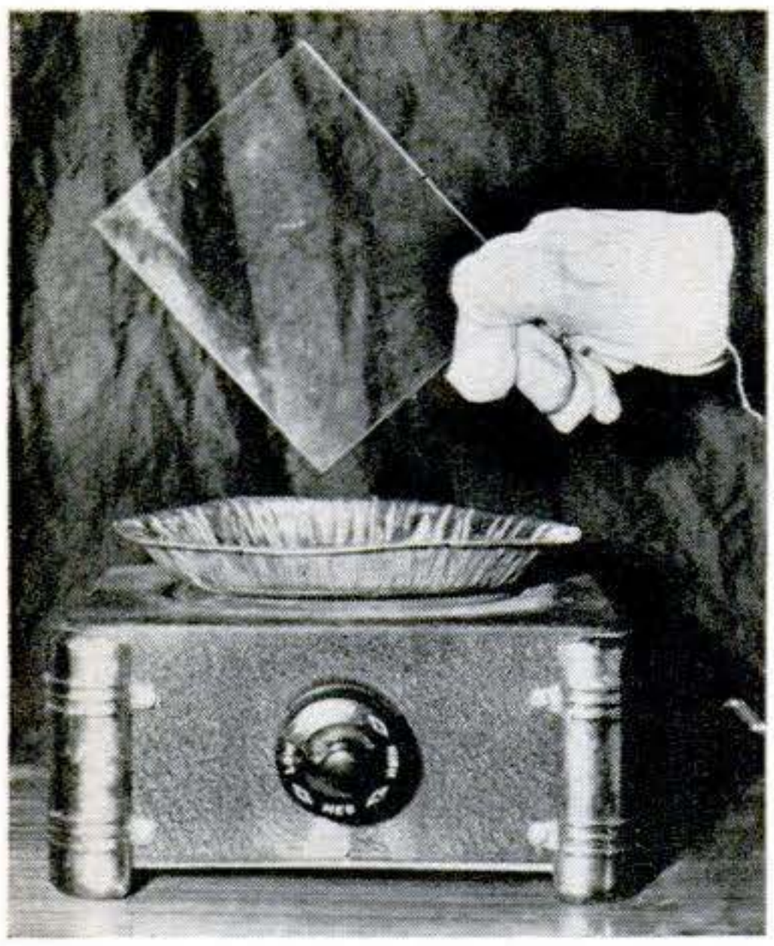
How crazy can you get? Like this crazy-house shot of Weegee making crazy-house photos.

Please turn the page to see how these pictures were made

And take a gander at this pair—the same long-necked bird in two different crazy-house poses.



How to shoot crazy-house pictures

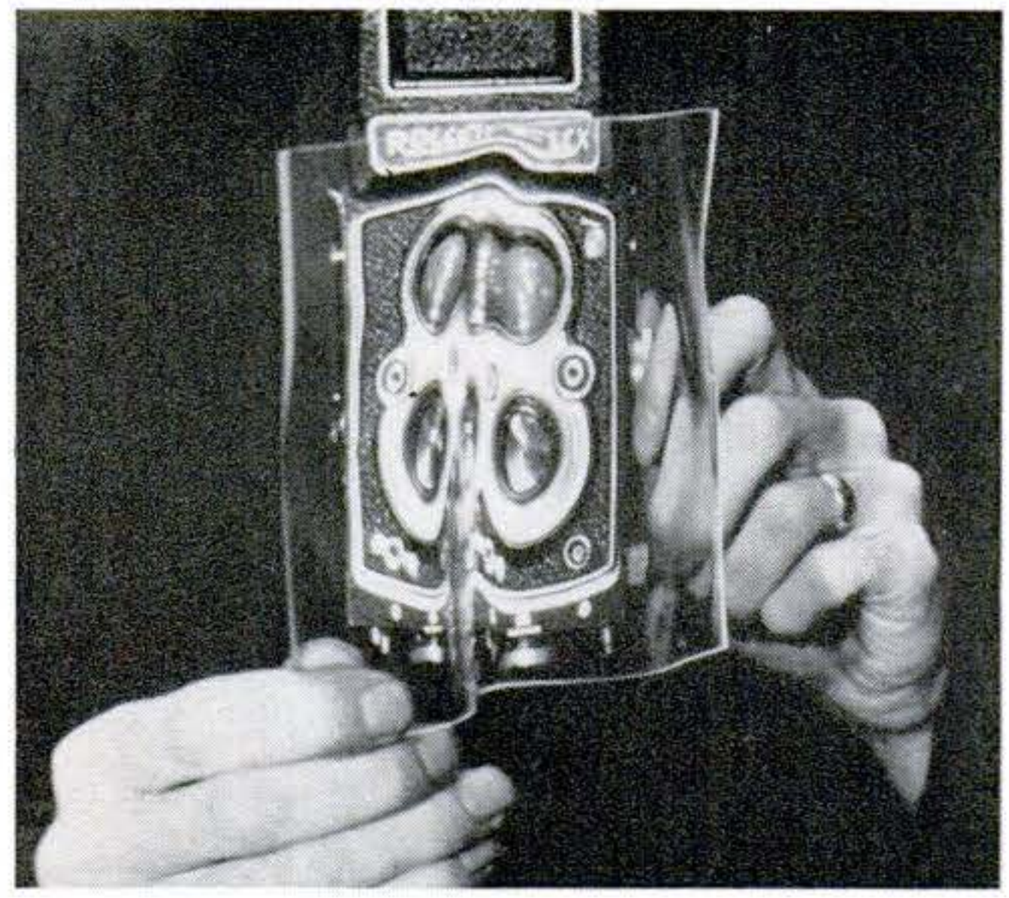


1

HEAT a sheet of clear plastic on an electric hot plate (1) or in an oven, pick it up with gloves and twist it slightly (2). Let it cool. Hold it in front of a camera while you shoot (3) and you'll get pictures of scenes that you might see in an amusement-park crazy house.

That's how the photos on the two preceding pages were made by Arthur Fellig, the fun-loving photographer whom New York and Hollywood photographers know as Weegee. The plastic bends the light rays and distorts the film image. Just a little twist is all you need. Too much would direct light away from the lens opening.

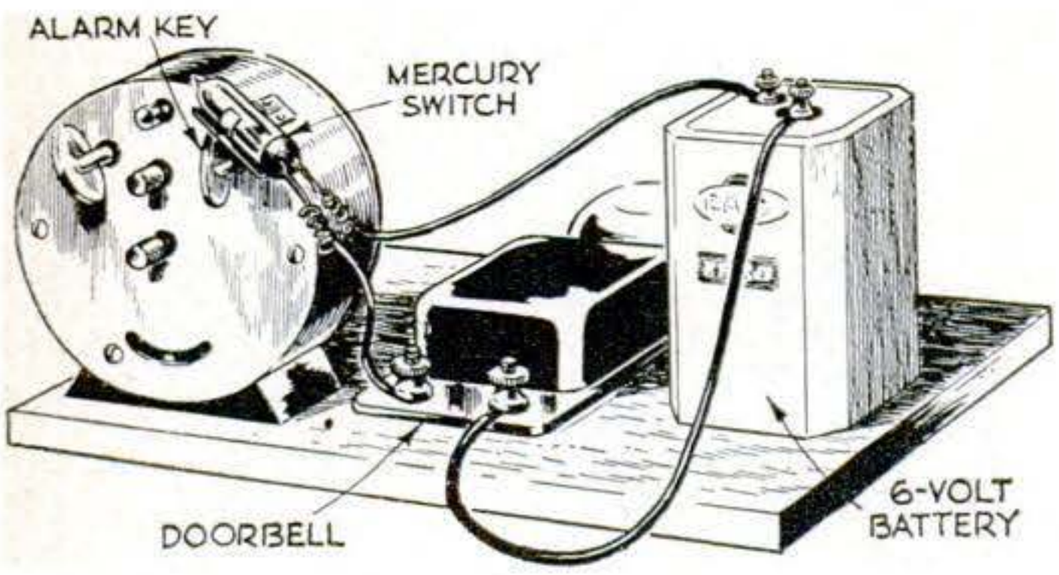
2

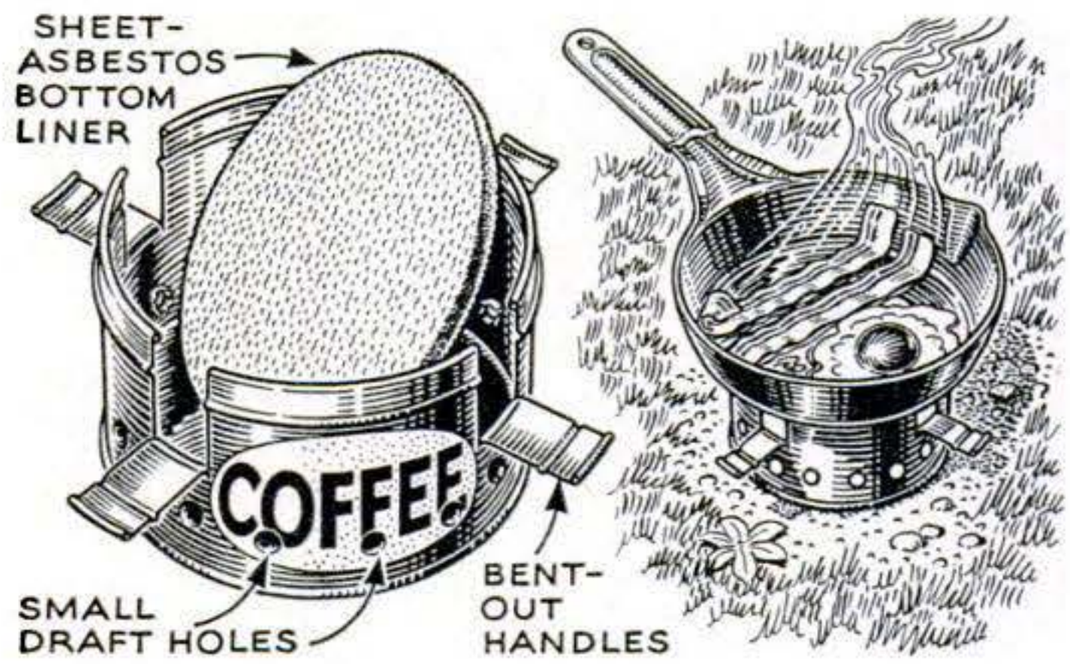


3

Alarm Clock Uses Mercury Tube

NO WIND-UP alarm clock rings long enough to wake me in the morning. Electric clocks are no good if the power is off. But my battery-powered alarm is sure-fire. When the alarm goes off, the winding key turns, tilting a mercury tube salvaged from a thermostat. The mercury bonds the circuit between a 6-volt battery and a doorbell. The bell rings until I'm wide-awake enough to get up and reset the hinged tube-mount in horizontal position, breaking the mercury contact.—*John L. Boyd, Chambersburg, Pa.*





Coffee Can Makes Camp Stove

A SMALL alcohol stove for quick outdoor cooking can be made from a coffee can. Punch a dozen or so vents near the bottom, and cut three or four strips halfway down for handles. Insert an asbestos disk, and pour on a small amount of alcohol, preferably wood alcohol, before each lighting. Rubbing alcohol will do in a pinch. You can make a stove for each pot or pan in use. —*E.W. Hargrave, Troy, N.Y.*

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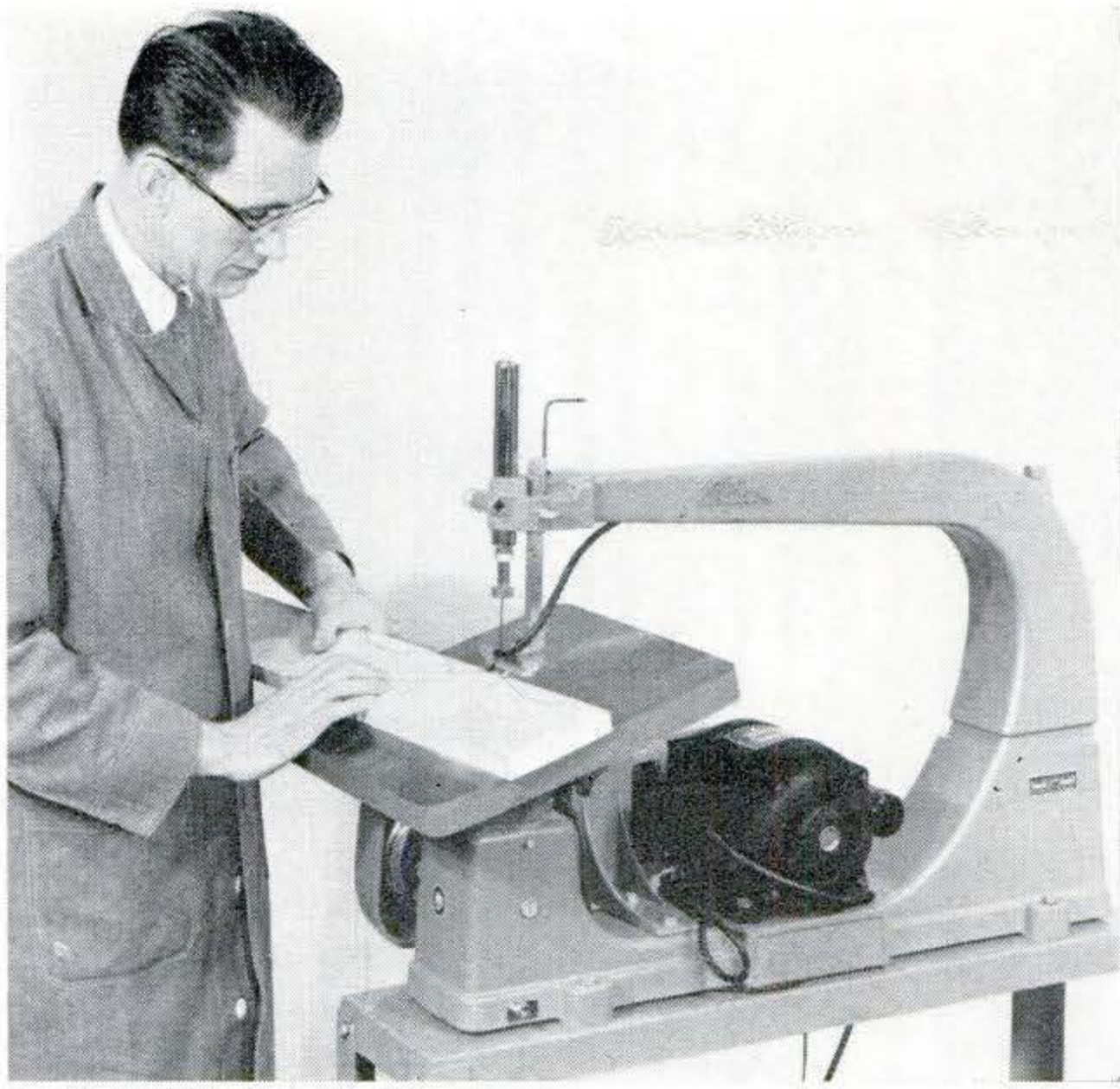
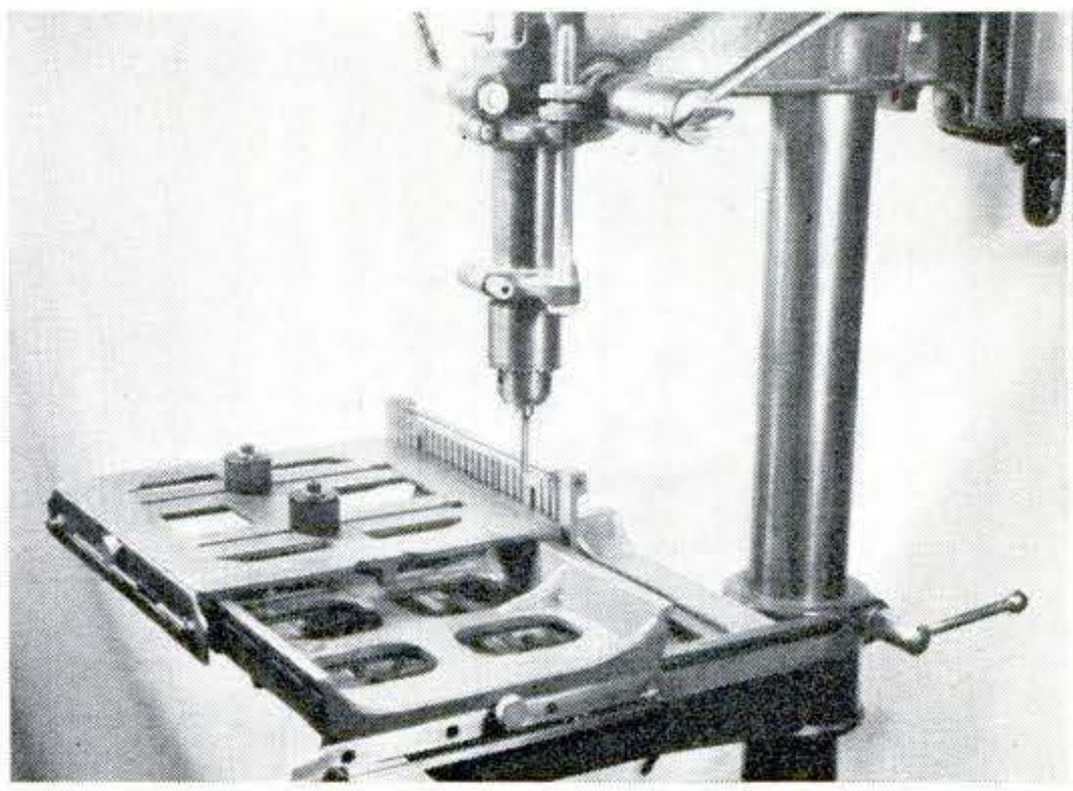
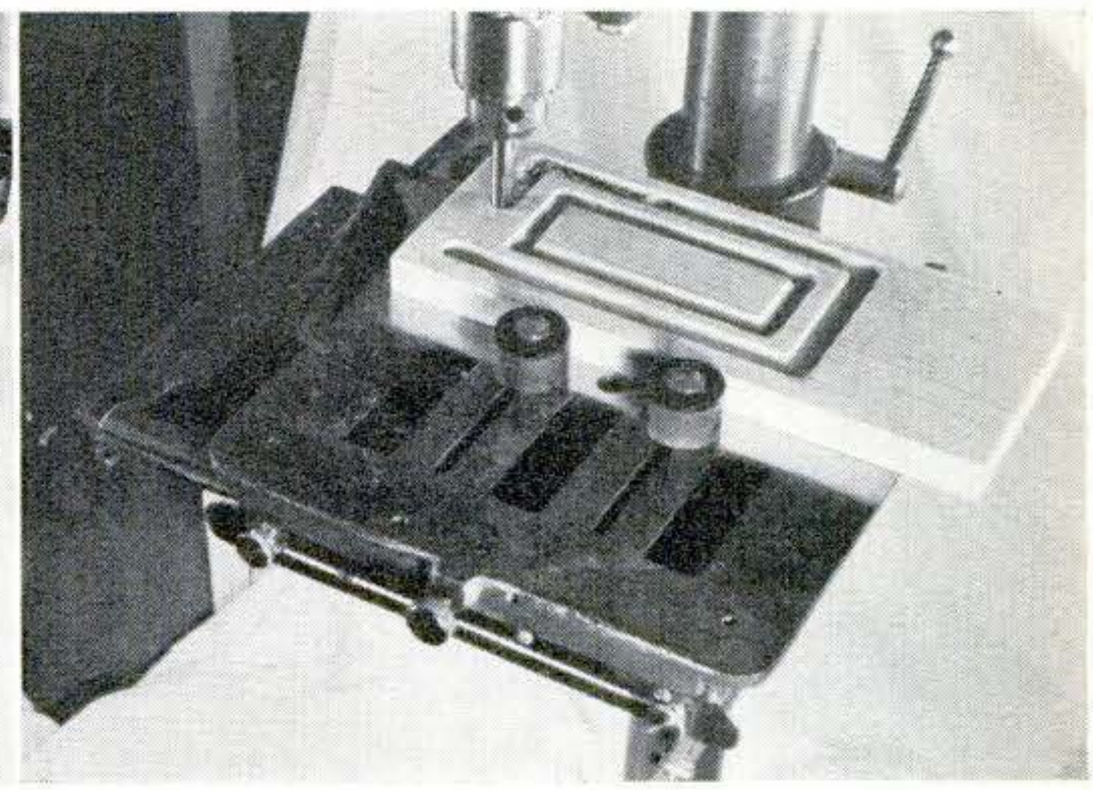


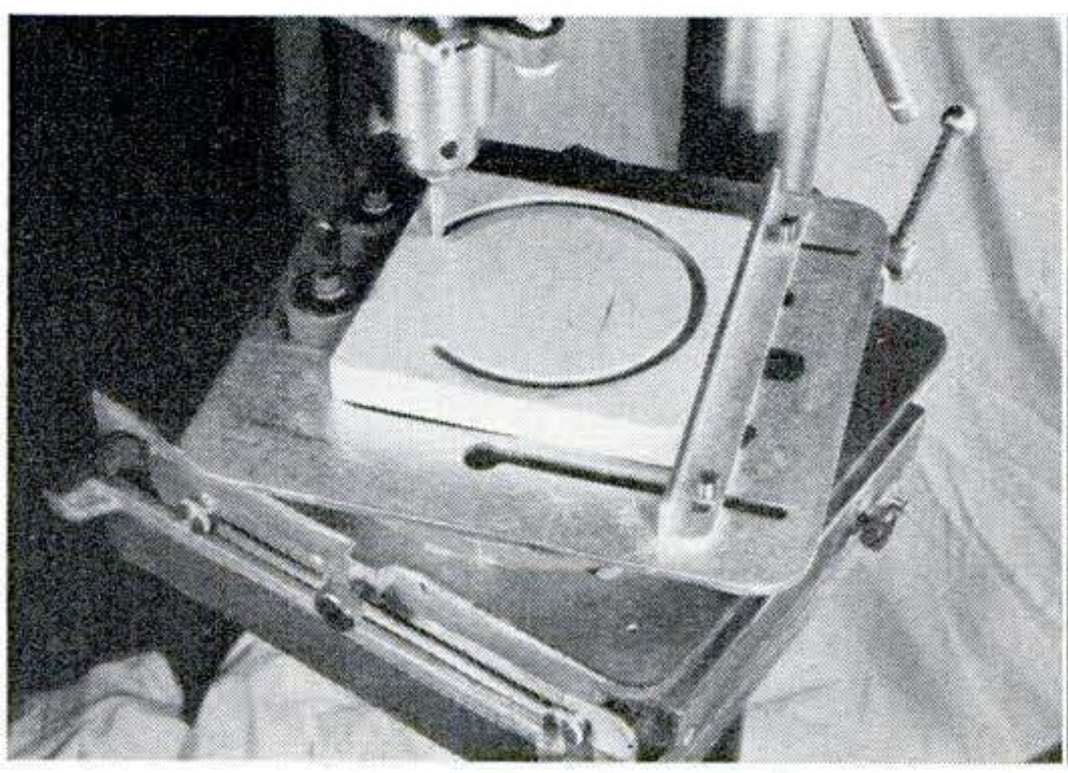
1. Jigsaw Table Swivels. You can make angular cuts any length you want on this jigsaw. The table swivels, and tilts down in the front so that you can feed long stock in from the side. In its regular position, it tilts up to 45° to one side and 15° to the other. The four-speed saw has a ball-bearing drive, a 24″ throat clearance and a maximum cutting depth of 2¼″.

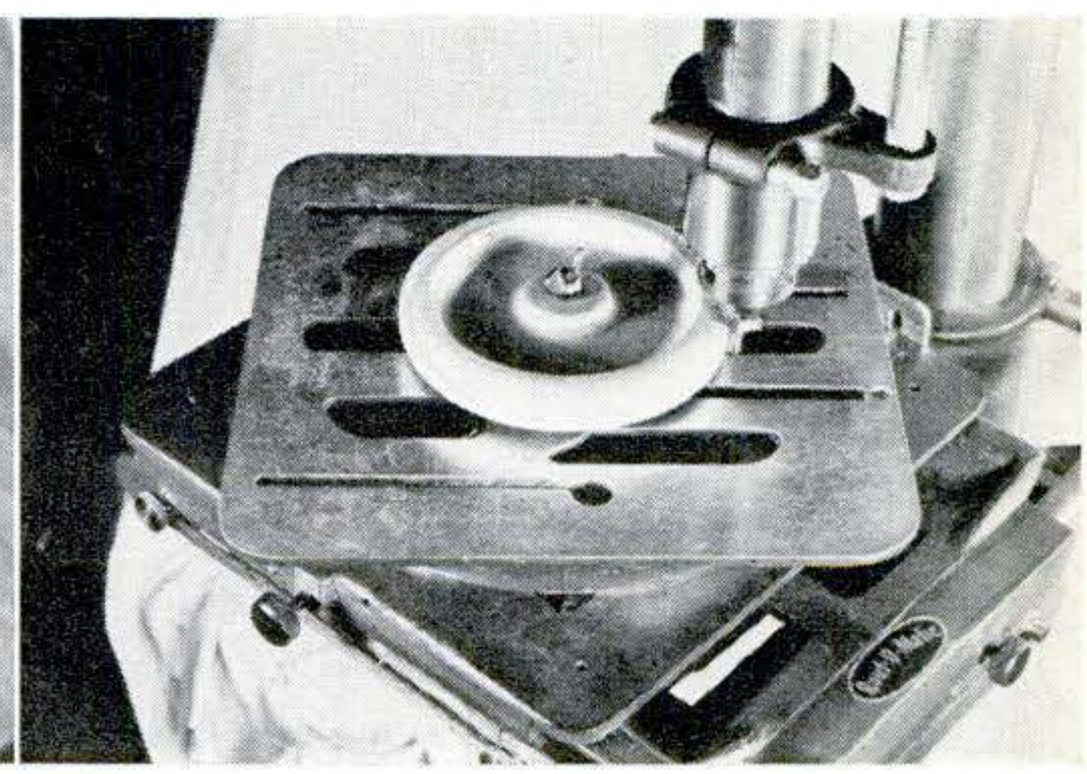
New Tools





2. Drill-Press Table Speeds Routing. By moving this accessory table, you can make fast, accurate cuts in any preset pattern you want. Two sliding carriages, one moving in and out and the other crosswise, position the work anywhere under the drill-press chuck (above). By setting limiting stops, cuts are made automatically in either direction and can be repeated on successive pieces (above right). For circular cuts the work is held on a rotating plate, either at the sides for internal routing (below left) or bolted at the center for edge-shaping wheels, rosettes and other ornaments (right).





Please turn the page for more new tools

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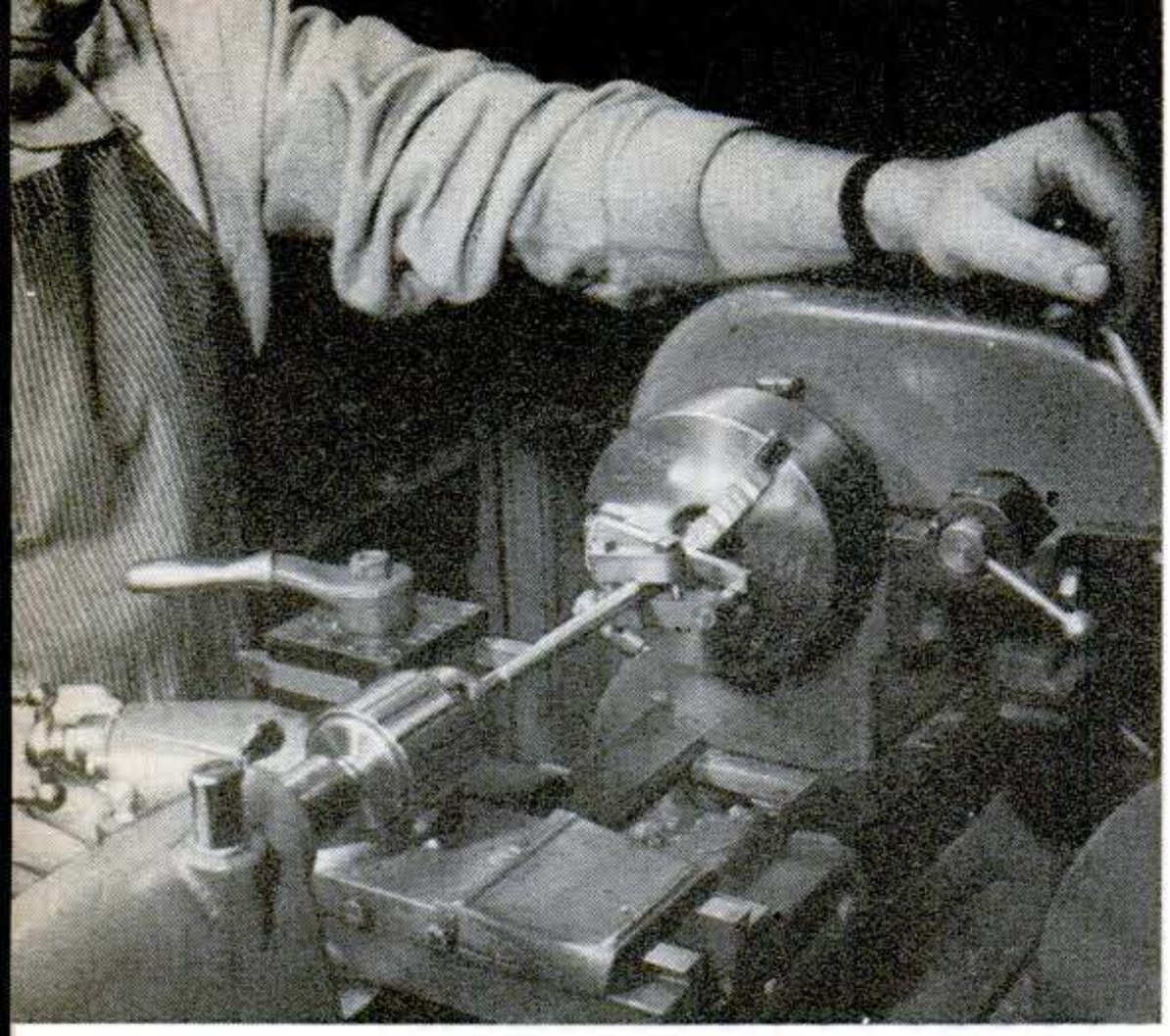
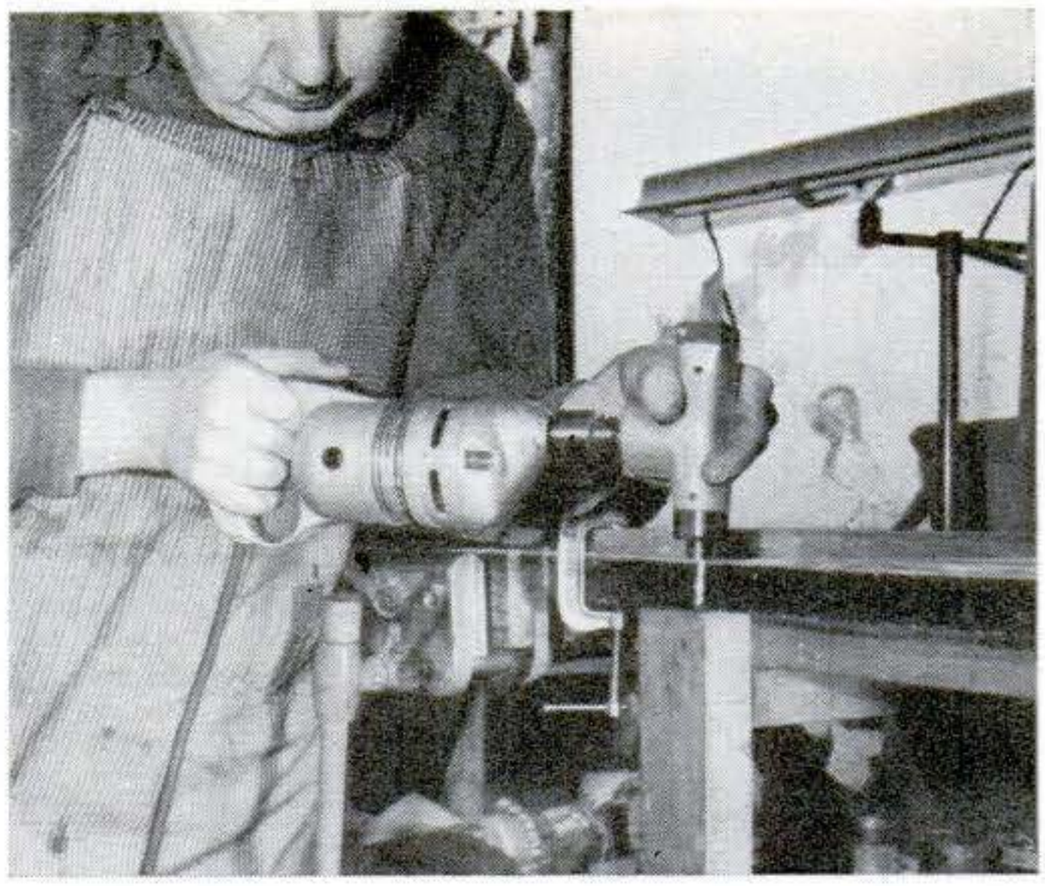
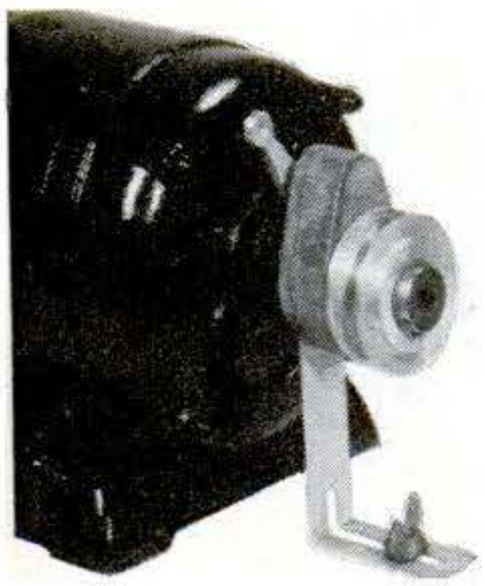


3. Center Fits Lathe Chuck. With this accessory, you can turn work between centers without stopping to remove the three-jaw chuck. The auxiliary center, fitted with a driving plate, is locked in the chuck like a piece of stock and the work mounted on it in the usual way. The center is soft so that you can turn it true. It can be removed and replaced when too short.



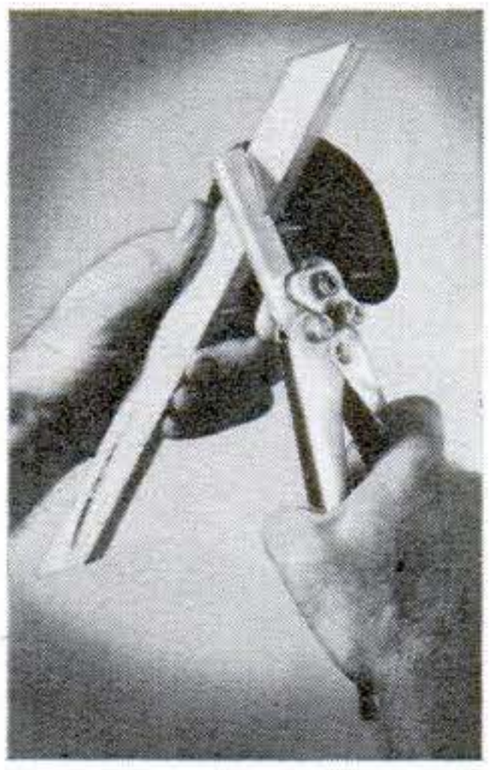
4. Saw Attachment Snips Metal, Too. This reciprocating tool has a saw blade on one end for cutting wood, metal and other materials without a starting hole, and a nibbler on the other end for slicing through thin sheet metal. Chucked in any electric drill, it takes various types of hacksaw blades and can also be fitted with files, rasps, chisels, gouges and impact hammers.

5. Baby Clutch Handles Big Loads. You can bring shop tools and other machinery to a smooth start or stop with this tiny clutch.

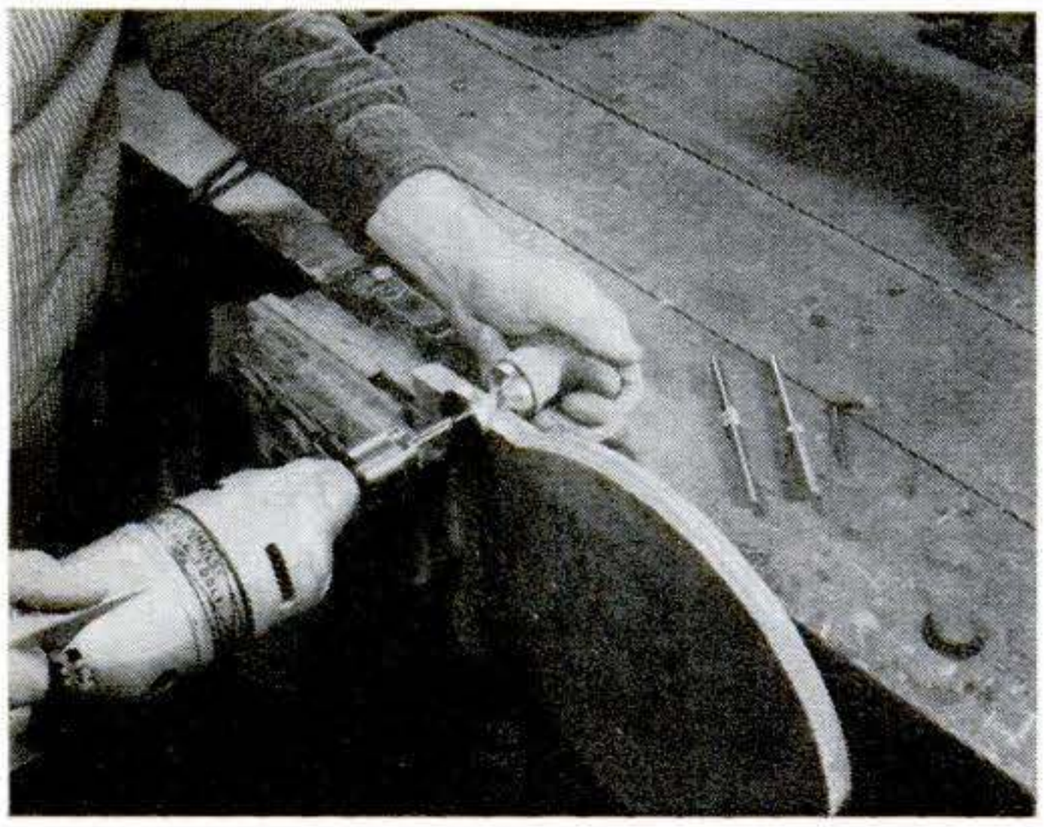


A coil spring, keyed to the pulley, wraps around the drive shaft when the clutch is engaged. When disengaged, the spring unwinds and the pulley freewheels. It comes for ½″ or ⅝″ shafts, for rotation in either direction, and can be used on gasoline or electric motors with a capacity up to two horsepower.

6. Tool Cuts Miters. You can cut a perfect miter every time by squeezing this plier-like tool.



The double-lever-action jaws multiply hand pressure 15 times to slice quickly through soft- or hardwood moldings and dowels, and materials such as plastic, rubber and linoleum. Pins in the base plate automatically align the stock at the correct angle for a 45° cut in either direction.



7. Drill Shapes Wood. Chuck the shaper bits at left in any ¼″ electric drill and you can make decorative cuts in wood from ⅛″ to 2½″ thick. A ball-bearing handle steadies the outer end of each bit as it is run along the edge. Six bits cut flutes, V grooves, single and double beads, and matching tongues and grooves for joints.

Further information about the tools described on this and the preceding page can be obtained from: 1. Atlas Press Co., 2642 N. Pitcher St., Kalamazoo, Mich.; 2. Akron Precision Equipment Co., P.O. Box 5255, Akron 13, Ohio; 3. Floyd McGuckin, 314 N. Monroe Ave., Ridgewood, N. J.; 4. Little Beaver Industries, 38809 Mentor Ave., Willoughby, Ohio; 5. Christensen Clutch Corp., 306 Dixon St., Compton, Calif.; 6. Wood Mitre Co., 8501 Stellar Drive, Culver City, Calif.; 7. Biddle Mfg. Co., Inc., 1318 Clark St., Racine, Wis.

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A new lightweight outfit makes it easy to do

Gas Welding in the Home Shop

By John Rogers

IF I'D been given a preview of what I could do with a gas-welding outfit—and what it was to do for me—I'd have plunked down the price for it long ago. Instead I just dreamed about getting one some day.

Finally I took the plunge. Since then I've made handsome wrought-iron furniture, built a utility trailer, repaired a lawn mower and a bicycle, done a job on the kitchen range, made an outdoor grill, bent metals easily, freed rust-frozen nuts and put back into service a set of broken andirons.

Nowadays I pick up the torch almost as often as I do my electric drill. A whole new field of projects has opened up. Instead of drilling, bolting and riveting, I cut and weld, and what I build is made for keeps. The big jobs are really no more difficult than small ones.

What started me on my way was a new lightweight rig*. Actually designed for the small pro shop, it seemed made for guys like me who want to weld, braze, solder, preheat and cut metal without buying any extras.

At a cost of just over $75, the kit includes a blowpipe, interchangeable welding and cutting tips, oxygen and acetylene regulators, hose, wrench, friction lighter and goggles. For $50 more you can obtain the oxygen and acetylene cylinders—when empty they can be exchanged for full ones at less than $4 each—and for another couple of dol-

** I have a Prest-O-Lite No. 420 kit.*

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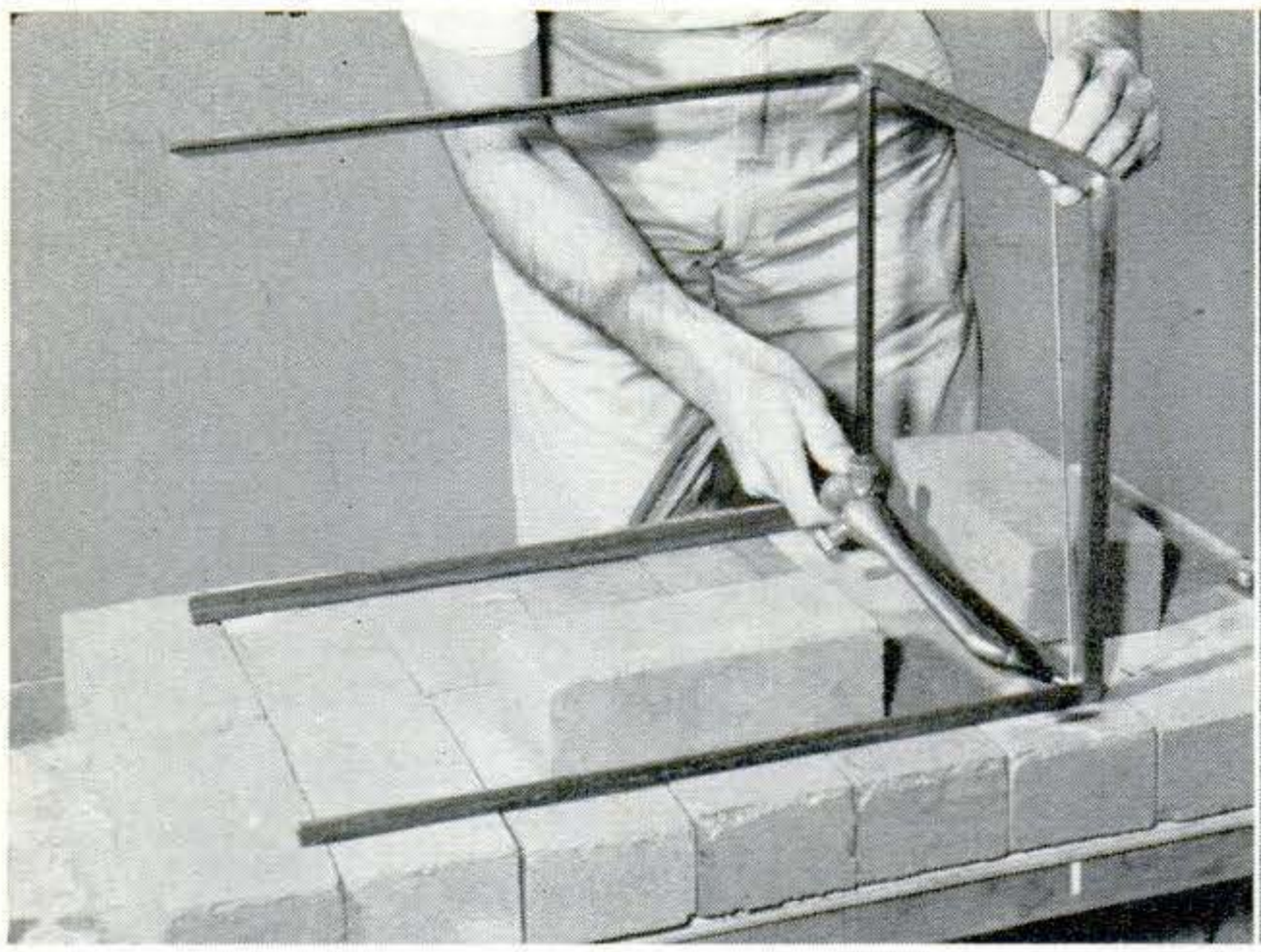
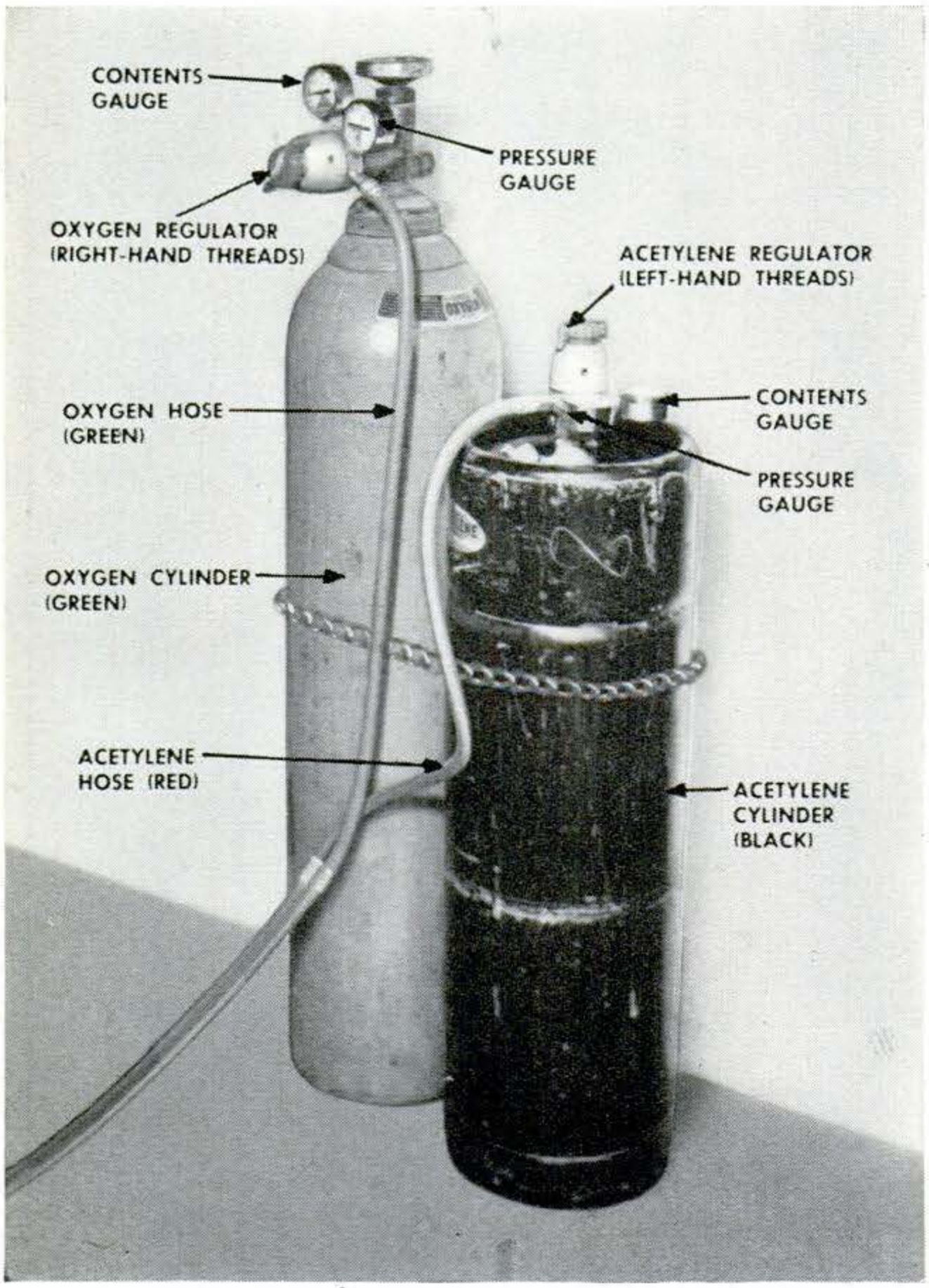


TEMPORARY WELDING BENCH can be made by placing firebricks on a sawhorse-supported asbestos board. The author later welded a permanent bench of angle iron and steel plate.

FIRST WELDING JOB attempted by the author was this table. The frame and legs are ½"-by-½" angle iron painted black. The top consists of squares of cork flooring glued to plywood.

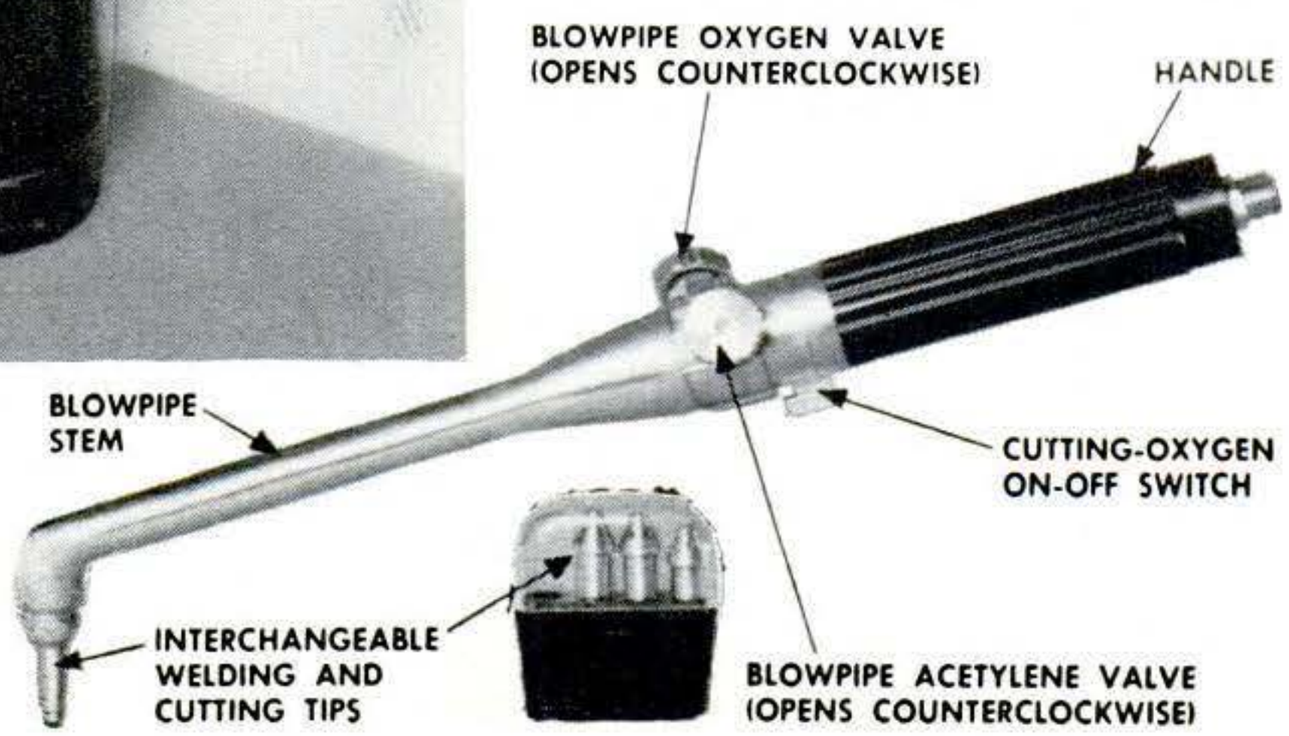


HERE'S WHAT YOU NEED for welding: Above, oxygen and acetylene cylinders and their fittings; at right, the blowpipe. All except the cylinders can be obtained in a handy kit.

lars you get a supply of welding rods that ought to last for several months.

Sure, there are some hazards in oxyacetylene welding —like driving a car or using a table saw—unless you follow the rules. There's a lot of explosive power in those cylinders, just as there is in the gas tank of your car. So take proper precautions when you use the outfit.

How to be safe. Never let the oxyacetylene flame come in contact with grease or other inflammable materials. Keep both cylinders upright at all times, and chain them to the wall so they won't tip over. Then stop worrying. Your insurance company thinks so little of welding as



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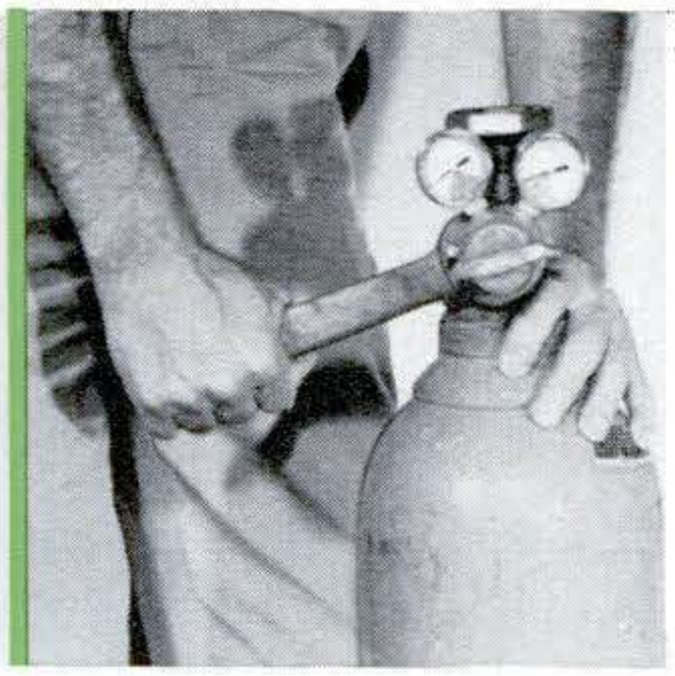
Here's how you set up the oxyacetylene equipment

1. REMOVE PROTECTIVE CAP on oxygen tank. Don't hammer.

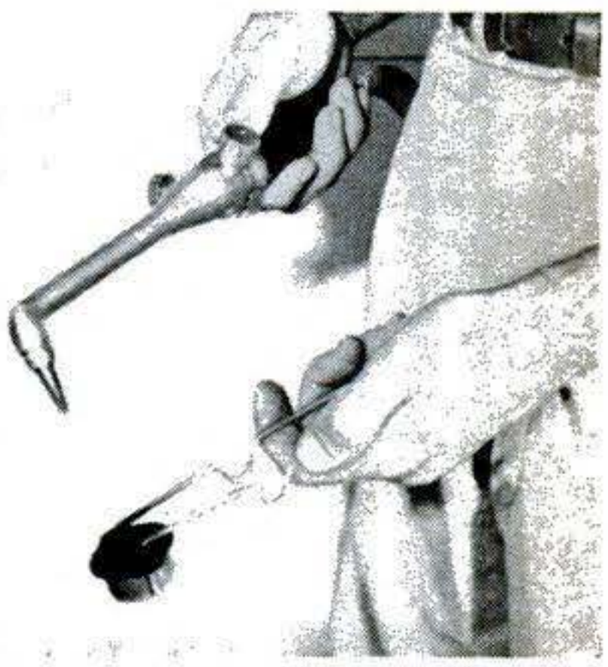


2. ATTACH THE REGULATOR to the oxygen cylinder.

3. ATTACH THE REGULATOR to the acetylene cylinder.

4. CONNECT HOSE to oxygen and acetylene cylinders.

5. OPEN VALVES and adjust pressure on both regulators.

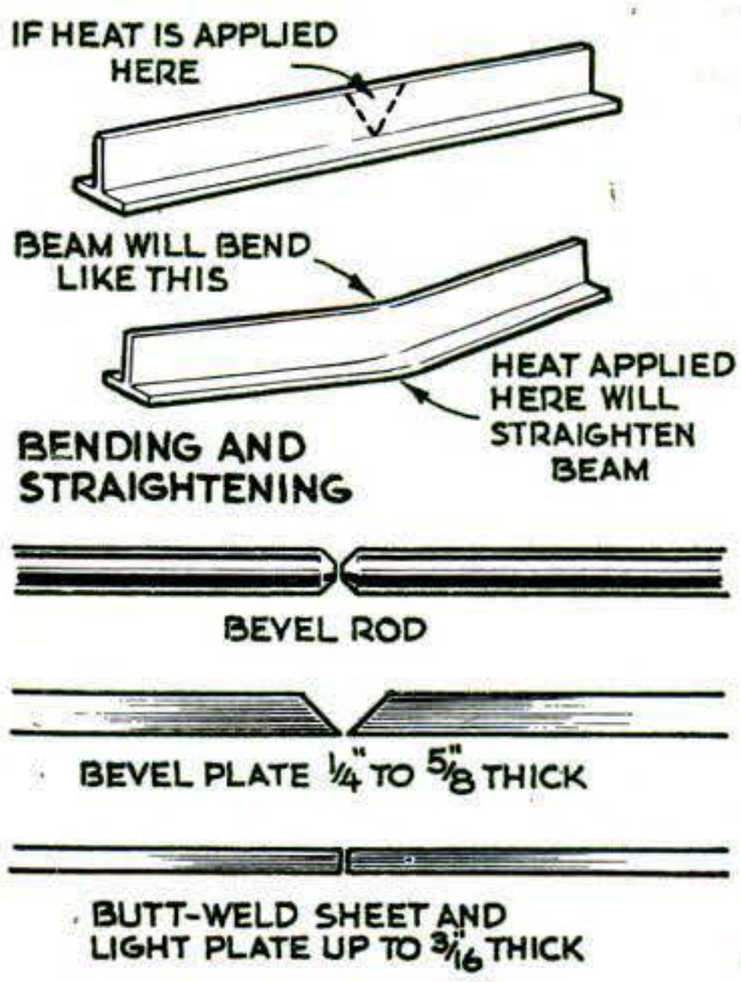


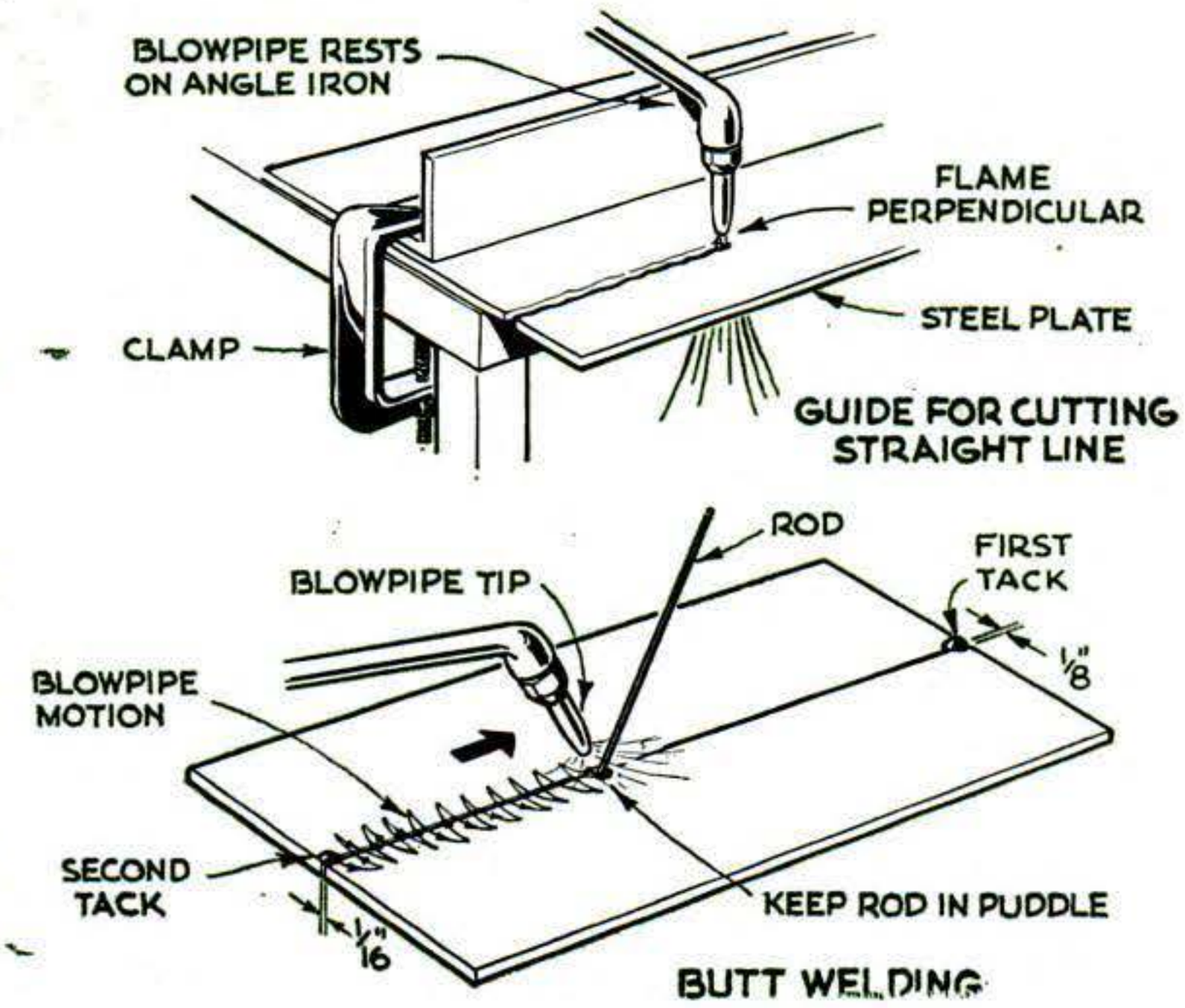
6. IGNITE BLOWPIPE with friction lighter, never a match.

a fire hazard that you'll find it's not among the restrictions in the policy on your house. But better check fire regulations in your community. They vary, and some are very stringent.

First steps. After chaining the tanks together and to the wall, remove the protective cap covering the oxygen-tank valve. If it won't start by hand, use a stick as a lever—never strike the metal with a hammer. Crack the valve on each cylinder momentarily to clear out dust

Tips on using an oxyacetylene welding outfit





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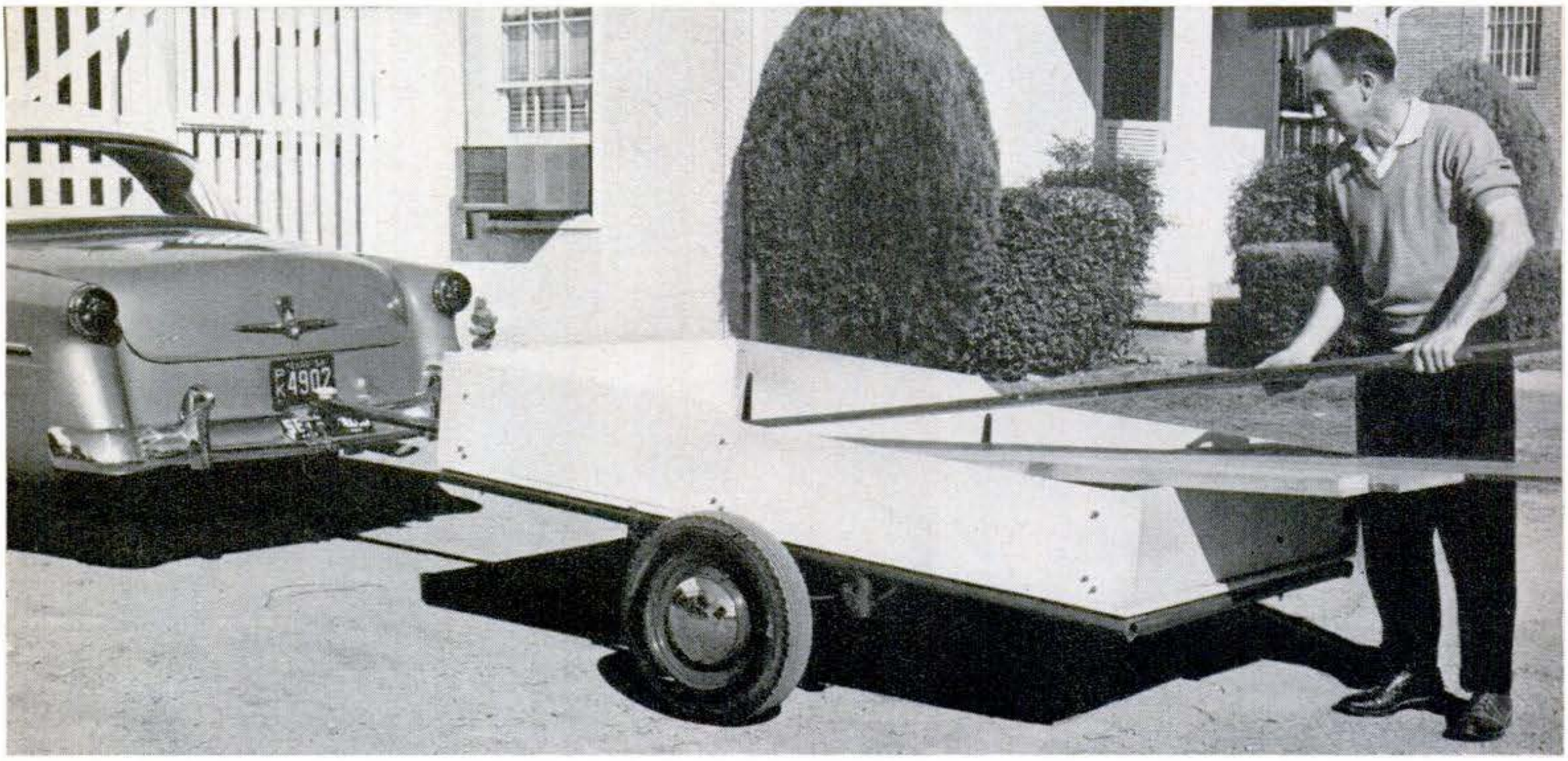
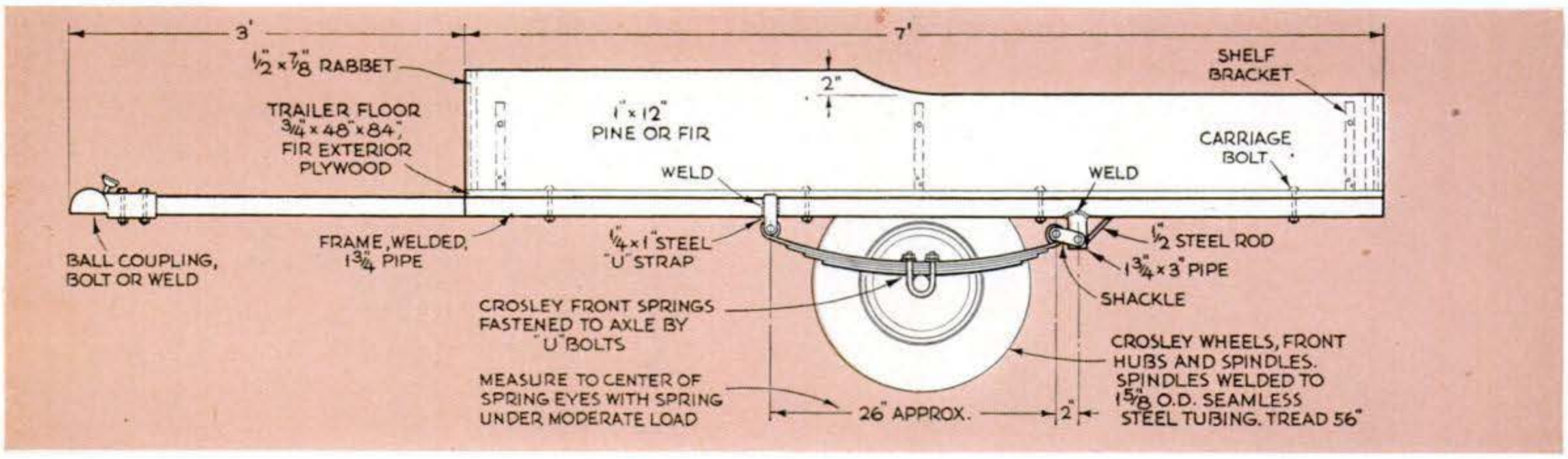
or dirt particles. Then attach the regulators, drawing the union nuts up tight to prevent leakage. The regulators are not interchangeable, but you can't get mixed up. All the oxygen connections have right-hand threads and the acetylene unions are all left-hand threaded.

Next, turn the pressure-adjusting screws on both regulators all the way out. This is important; it prevents sudden high pressure on the diaphragm. Slowly open the oxygen-cylinder valve all the

How the author built a lightweight utility trailer

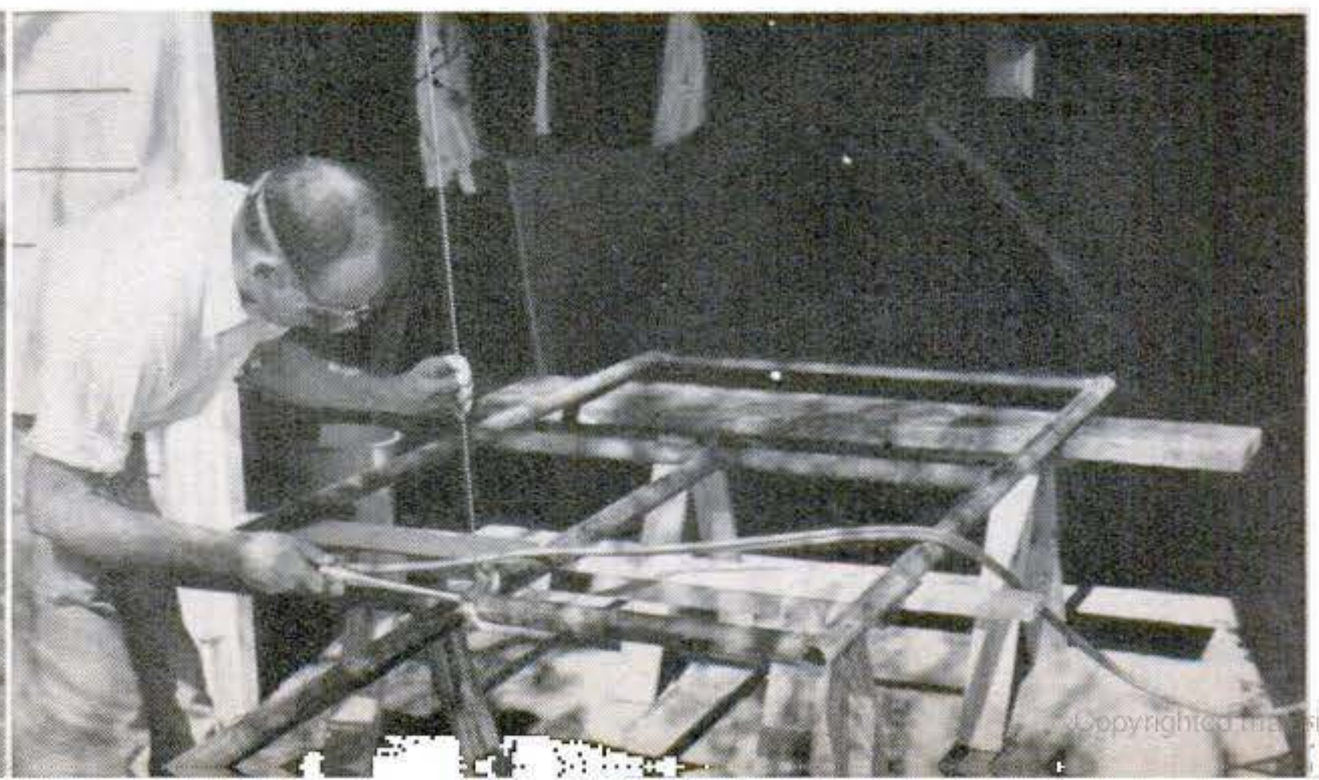


CHASSIS WAS WELDED from 1¾" pipe. Running gear consists of Crosley springs, wheels and front spindles. The ends of the wood body, held in rabbets, slide out to carry long objects.



CROSS MEMBERS at back and center are welded to pipes forming chassis sides. Lay sides on level surface. You can hold cross members in place with clamps or twisted wires.

TONGUE IS WELDED to chassis, first to center cross member and then to two short pipes that make front. To get best weld, shape ends of cross members slightly concave to fit sides.



way, and then the acetylene-cylinder valve slowly for 1½ turns, leaving the T wrench in place until you shut off the cylinder at the end of the job.

With hose, blowpipe and tip attached, open the oxygen valve on the blowpipe and adjust the tank regulator gauge to the desired pressure. Then close the blowpipe valve. Adjust the acetylene regulator gauge with the blowpipe valve closed. A table of operating pressures is given in the instruction booklet.

Firing up. This sets you up for welding, so slip on your goggles. Open slightly first the blowpipe oxygen valve and then the blowpipe acetylene valve. Ignite immediately with sparks from the friction lighter. Don't use a match; gas pressure may blow it out. Then adjust the flame with more oxygen. I had the dealer show me how. It took him only five minutes to set up an outfit, and I could see what a properly adjusted flame should look like. Unlike the right- and left-hand threads on the oxygen and acetylene connections, both of the blowpipe valves open and close normally—that is, counterclockwise to open and clockwise to close.

Welding is easy—simply a process of fusing two pieces of metal together. The rod adds extra metal to fill in the gap and make the joint strong.

With the work wire-brushed clean of all rust, scale and grease, heat the start of the weld until it sweats and forms a small molten pool, or puddle. Hold the blowpipe at a sharp angle and, keeping the rod in the puddle at all times, push the flame along the seam—from right to left if you're right-handed. Play the flame on both sides of the rod in continuous small semicircles. It takes a steady hand. A comfortable working position can be a big help.

Avoid distortion. Intense heat expands metal, so leave a small gap between the two pieces—about 1/16″ at the start of the weld and ⅛″ at the end. Tack welds at both ends will lessen distortion.

Cutting with the blowpipe is even easier. Attach the cutting tip, heat with a normal welding flame and flip on the cutting-oxygen switch. The cutting tip supplied will cut through a ⅜″ thickness. One for heavier duty is available.

Remember, when you are using the blowpipe and tips or putting them away after a job, that they are precision instruments. Avoid abusing them, keep them clean, and they will give you a lot of service. If any of the equipment doesn't appear to be working right, have it checked by your dealer.

Follow the rules. For self-protection, wear your goggles. Don't wear greasy clothing, and never use grease or oil on any part of the equipment or connections. Oil and grease ignite violently in the presence of oxygen under pressure. And don't weld near inflammable material. Clean the floor in the work area and, if it is wood, wet it down. When cutting, provide a pan or bucket of water or sand to catch dripping slag. Before welding or cutting a container that has held inflammable material, wash it thoroughly and keep it filled with water during the entire time the job is in progress.

All are obvious rules. With care at the start, they soon become second nature, and you'll have fun. END

AXLE OF SEAMLESS STEEL TUBING with spindles welded to ends is held to springs by U bolts. Springs are attached to chassis frame by shackle at rear and U strap at front.

COUPLING IS BOLTED to tongue. It could be welded, but bolts enable you to use it on a second trailer—although chassis is adaptable for hauling a boat or other equipment.

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The Easy Way to Build Water Skis

SKIS ARE ADJUSTED to a snug fit with sliding heel plates that take any foot size from five to 13. On a low dock like this, you can take off from sitting start as towboat sweeps by.

THOSE fancy skis you've seen skimming the water behind speedy boats are now available in kits. You can put a pair together in a few hours.

The ski blanks, made of nine-ply Philippine mahogany, come already molded to shape, saving the steamy job of bending your own. After light sanding, they're ready for filling, sealing and varnishing —with materials supplied with the kit.

Attaching the harnesses that hold your feet calls for drilling 10 holes in each ski, but a template makes this easy.

About the only thing not included is the skiing technique, and this comes with practice. The easiest way to start is from a crouching position in shallow water, while the boat pulls you slowly to the surface. Later, you can make snap starts from a dock or sloping beach.

You don't need your own boat, either. Friendly owners are usually glad to swap you a tow for a ride. The General Marine Co., Sixth and Oak Sts., St. Joseph, Mo., makes the kits.

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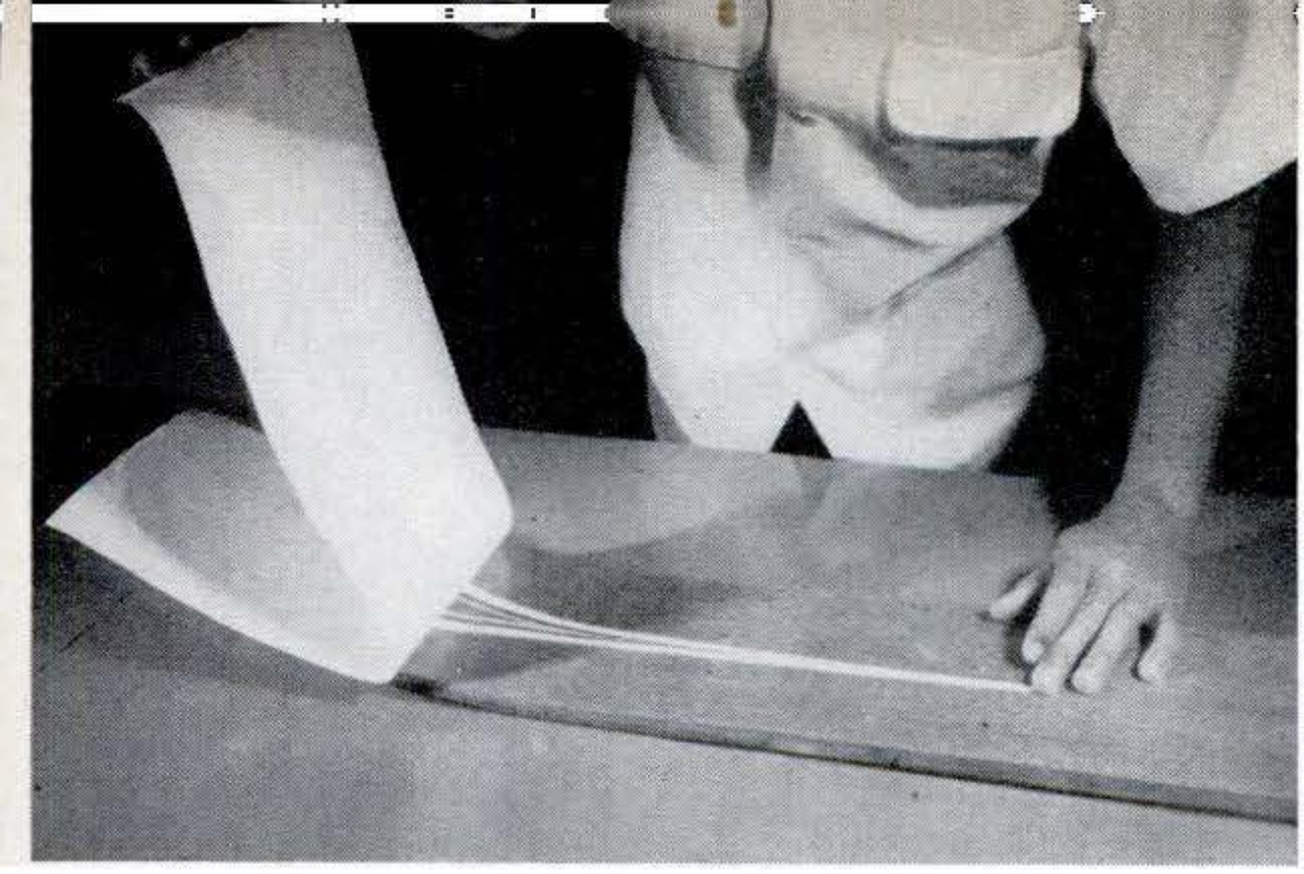
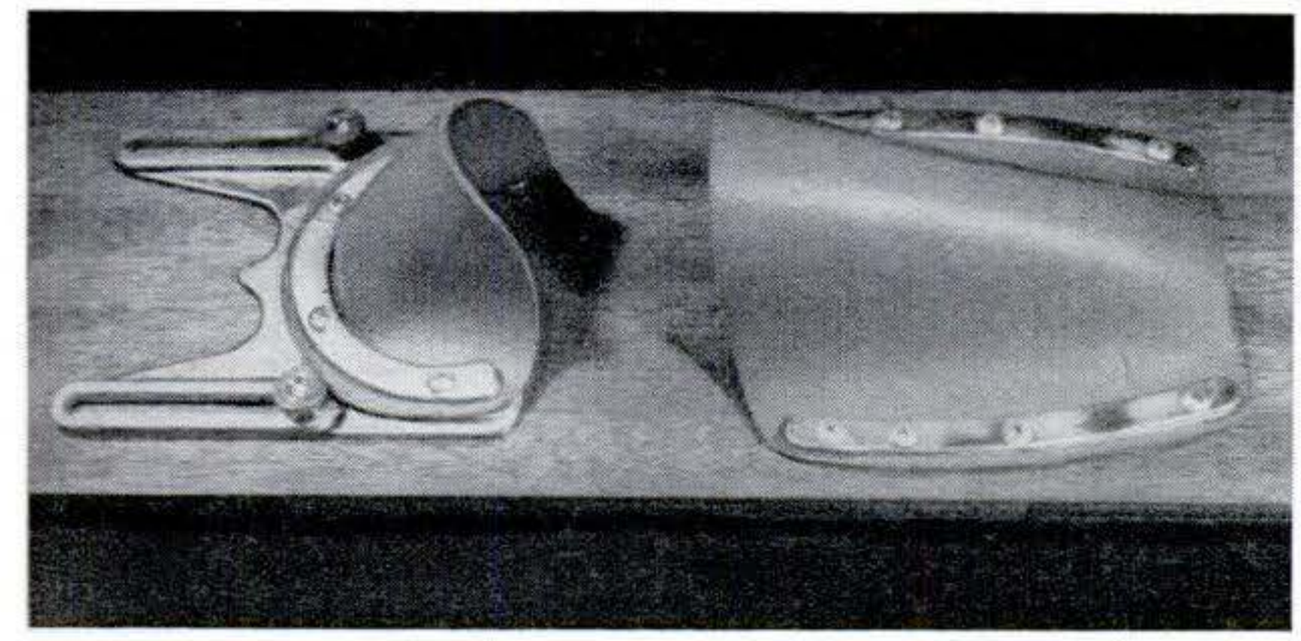
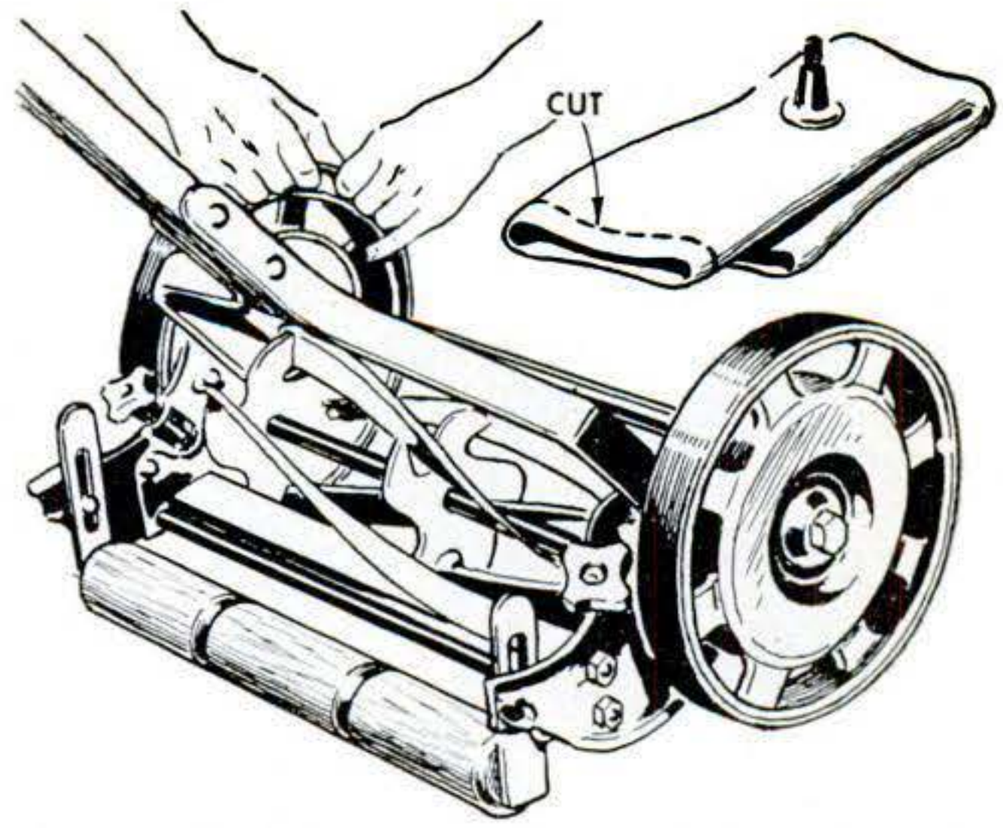


CUSTOM TOUCH is added with colored decals, soaked in water and stripped on skis after finishing. One coat of varnish will do, but three give lasting protection against water.

SKI MUST BALANCE at point where your foot goes so there is no uneven weight to hinder control. You can find this point by leveling each ski over dowel clamped to a bench.

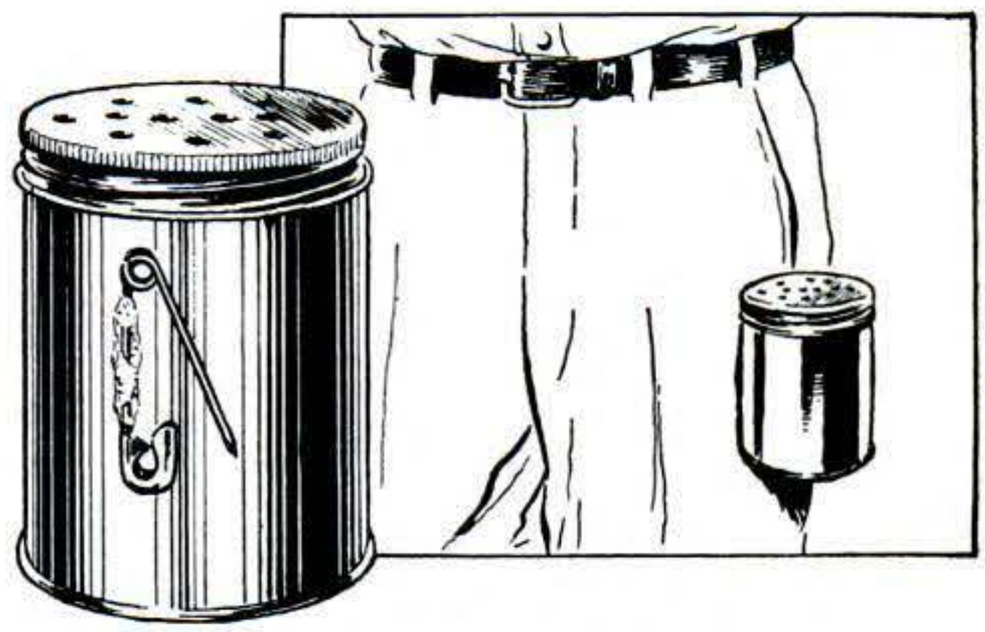


METAL MOLDINGS clamp sheet-rubber foot harness to ski so that rubber can't tear out under screws. Slotted heel plate slides under knurled nuts that lock plate where you want it.



Bands Silence Mower Wheels

You can take the clatter out of worn or metal lawn-mower wheels with treads cut from an old inner tube. You simply apply rubber cement and stretch the rings on. Build up layers as desired. *—Victor H. Lamoy, Upper Jay, N.Y.*



Bait Can Pins to Fisherman

Your worms won't fall overboard with this pin-on bait container made by soldering a safety pin to a small tin can. Try to find one with a reusable lid in which you can punch holes. Or you can use an ordinary can with cheesecloth held on by a rubber band. *—L. W. Mitchell, Carrsville, Ky.*

Extra Shear Pin for Outboard

That long row back to the dock when your outboard breaks a shear pin can be avoided if you carry a spare. A good place to keep one is in a hole drilled in the starting-cord handle. Seal it in with wax or waterproof adhesive tape. *—R. M. Woodbury, Natick, Mass.*

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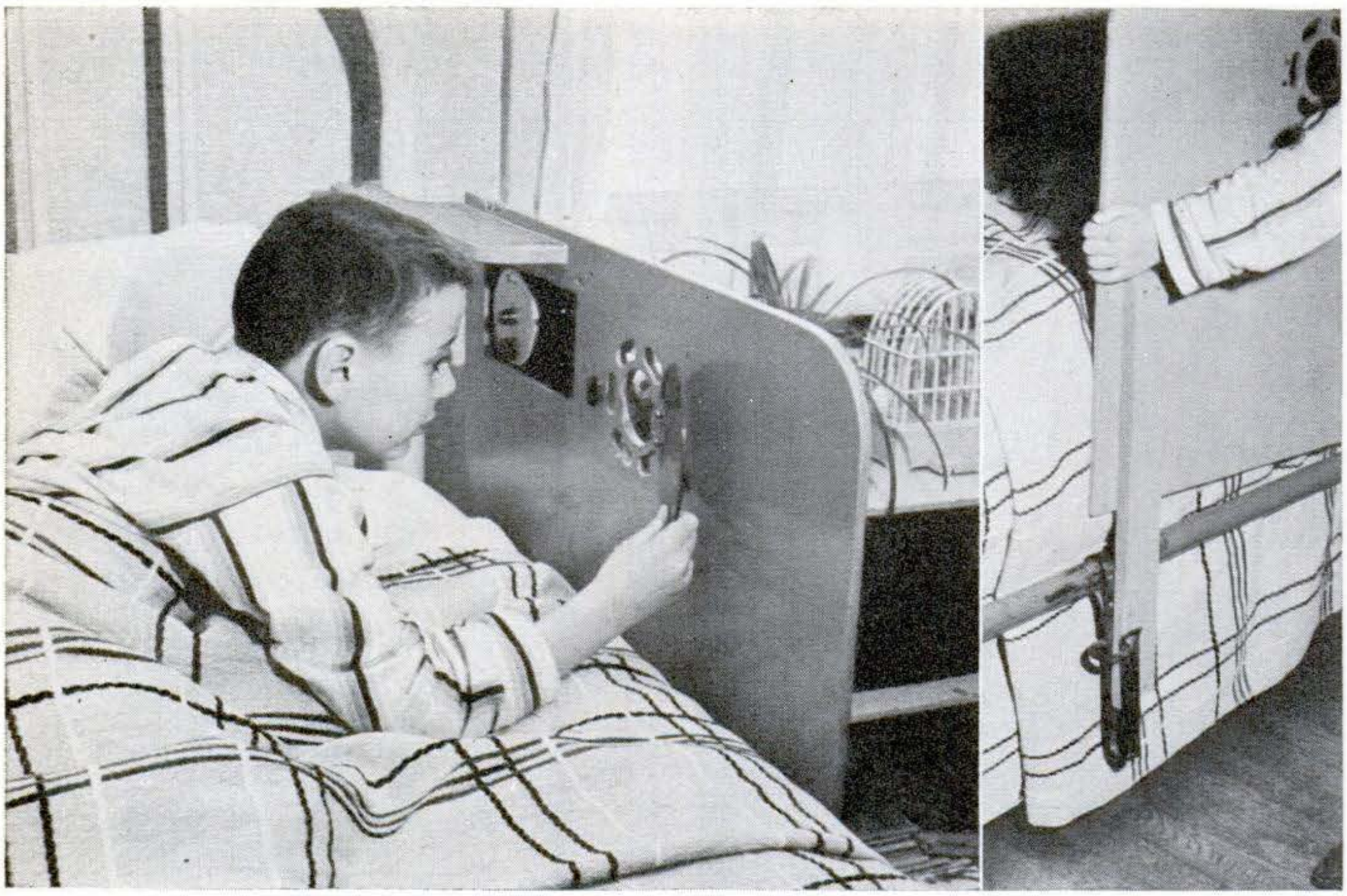


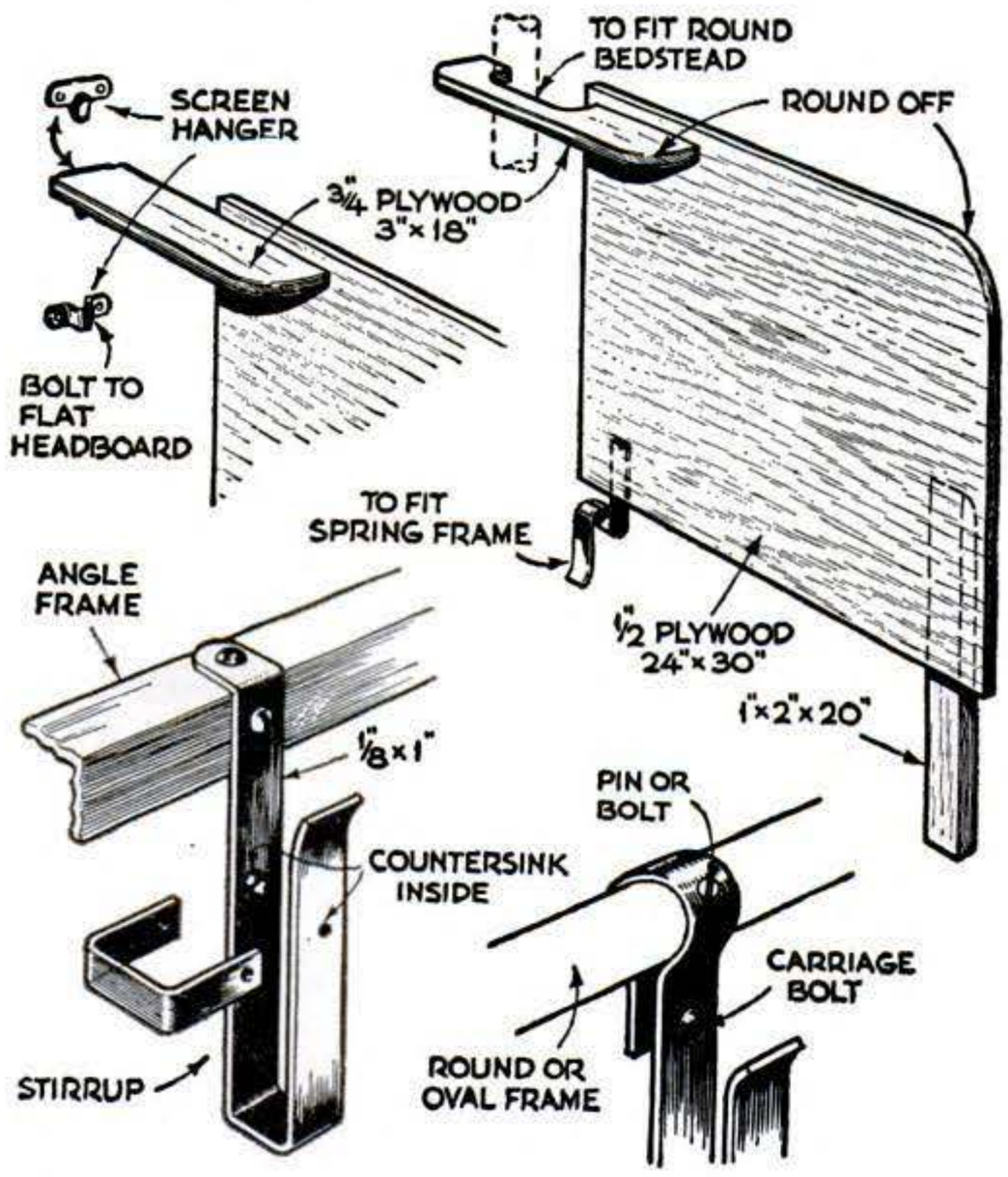
Spaceship Bed Guard Keeps Slumbering Pilot Safely Aboard

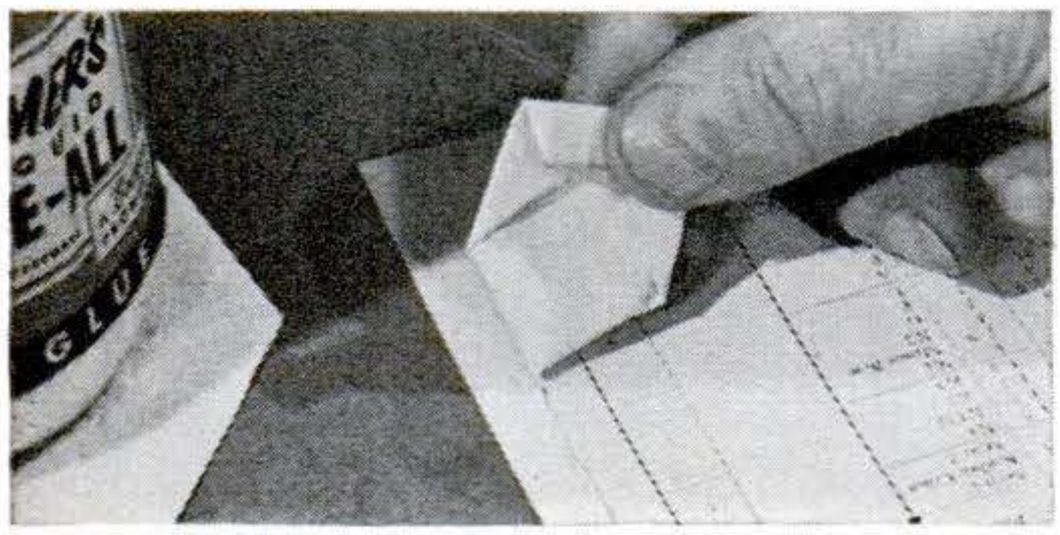
THE high altitude of an old-fashioned bedstead won't ground your young space pilot if there's a guard on it. Tricked out with a spaceship port made of transparent blue plastic and a small radio, it will even induce him to take off for slumberland more willingly.

Use ⅜″ or ½″ plywood for the panel, and ¾″ stock for the brace that engages the head end. For the type of metal bed shown, the brace is notched to hook around the inside and back of the round frame. If the headboard is a solid one, screw half of a screen hanger to it and the other half to the panel.

A stirrup, bent from ⅛″-by-1″ strap iron, is bolted to the spring frame or bed rail, and the leg on the panel is slipped into it (above right).

A smaller bracket, shaped to hook over the same rail, is bolted to the headboard end of the panel to hold it in place.





Folded Envelope Spreads Glue

A CORNER cut from an envelope makes a handy, disposable spreader for applying glue in a thin line. Half-fill the cut section with glue and fold over open sides to prevent leakage. Snip off the point of the corner, and force the glue out by light finger pressure.—*Ken Murray, Colon, Mich.*

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Carbide Mortar Makes Big Bang

By Evan Wright

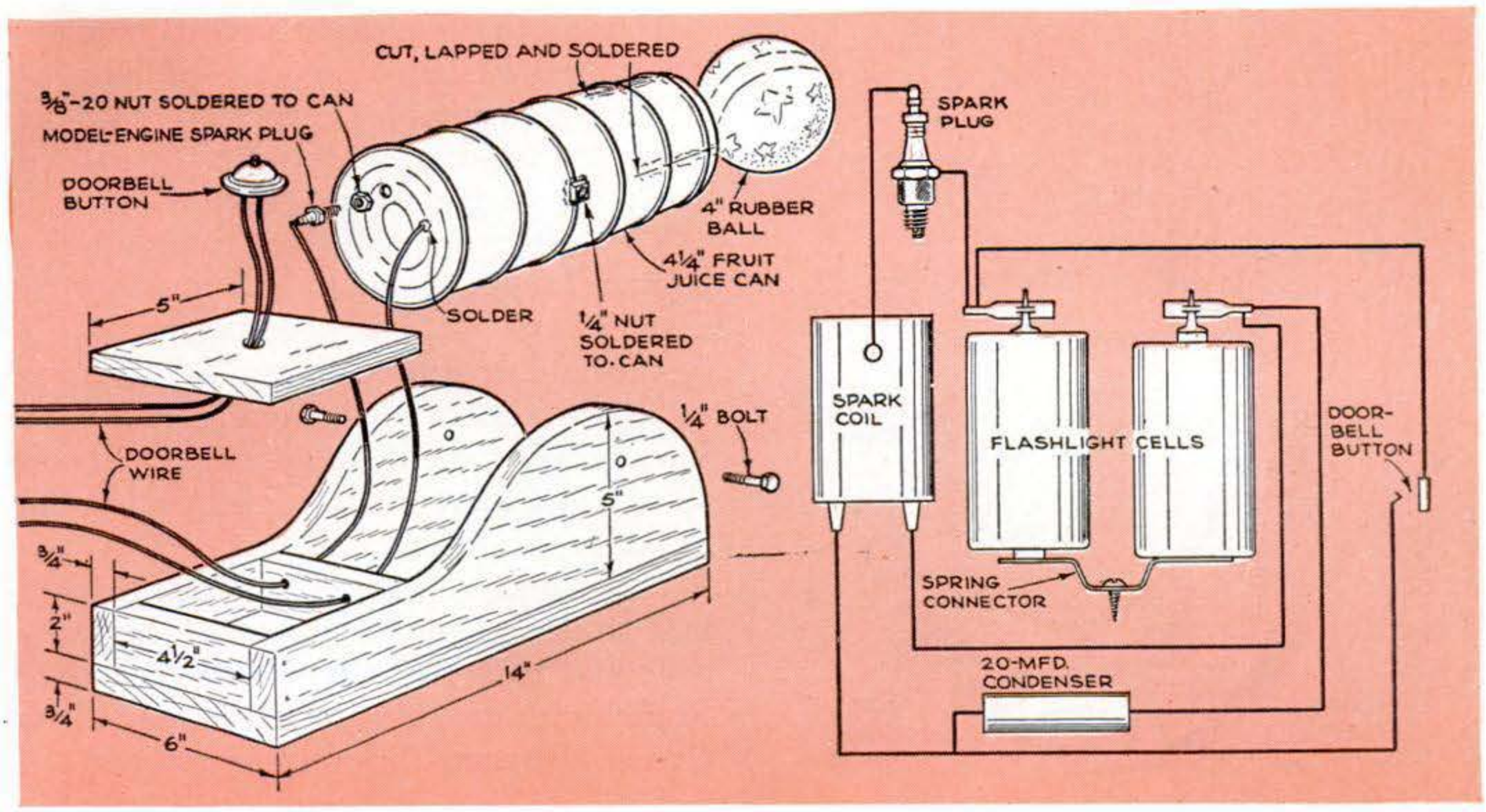
THIS little mortar can be heard for blocks, and a young artilleryman can fire it from dawn to dusk on a quarter's worth of calcium carbide. The chemical generates acetylene gas for harmlessly small explosions behind a soft rubber ball.

The mortar barrel is a large fruit-juice can (4½″ by 7″). To bring the muzzle down to a snug fit for a 4″ ball, cut four equally spaced slots a couple of inches long in the front, lap the edges slightly, and solder the seams. Quarter-inch nuts, soldered to the can sides, act as trunnions. A thin ⅜″-20 nut, soldered over a hole in the bottom of the can, forms a fitting for the detonator—a model-engine spark plug.

The mortar base is made from ¾″ plywood. Besides supporting the barrel, it houses a small ignition system, consisting of two flashlight batteries, a model-airplane spark coil, a 20-microfarad radio condenser and a doorbell button.

When the button is pushed down, the condenser takes up a small charge from the batteries. This charge surges through the coil when the button is released, producing a hot spark at the plug.

To fire the mortar, tip up the barrel at a 45° angle and drop in two rice-size pieces of carbide (adding more will make the explosion no bigger). Add a teaspoon of water, jam the ball in the muzzle, and let the gas generate for half a minute. Push down the button momentarily, then release it, and—*boom*. There goes that ball!



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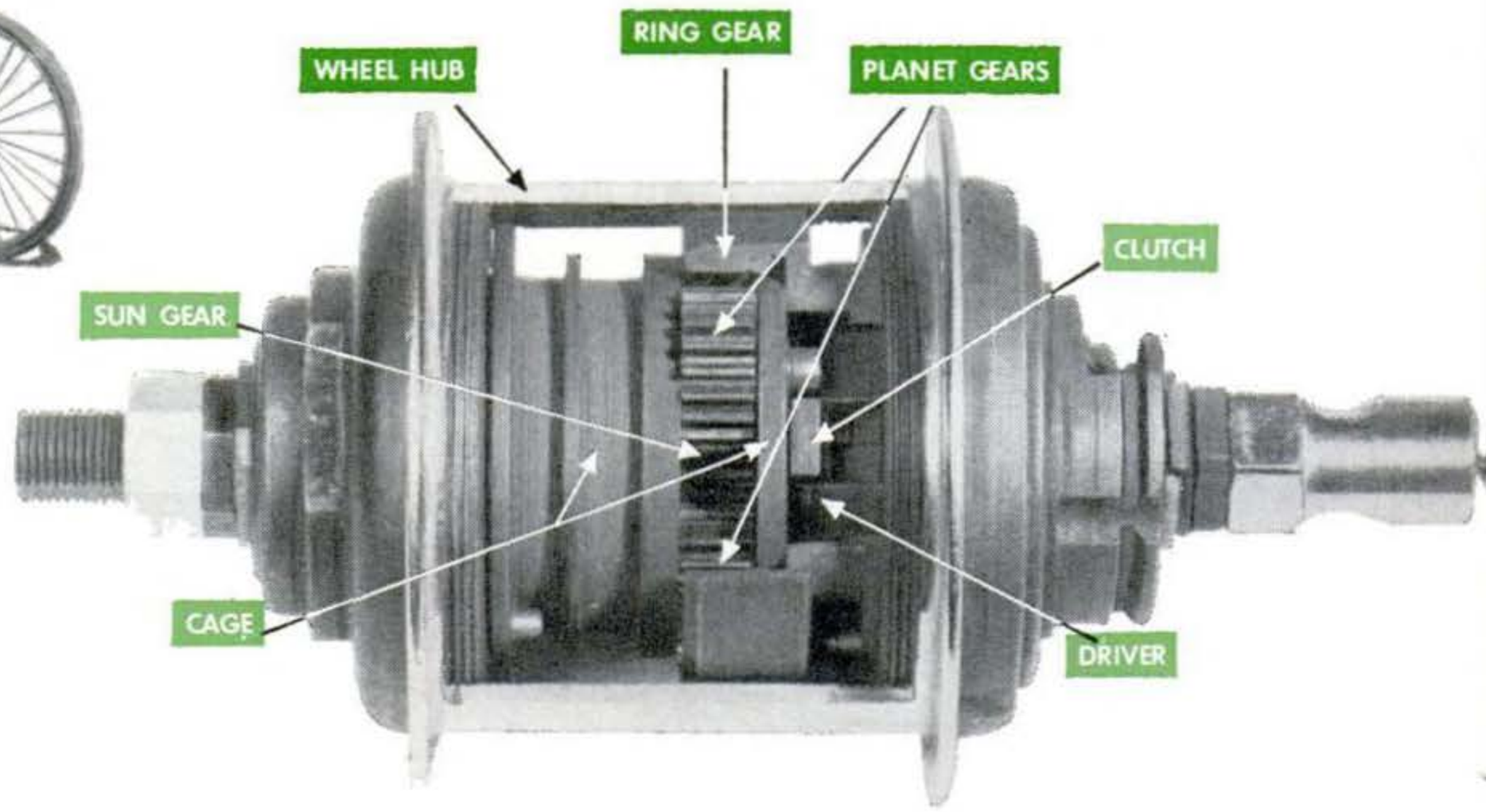
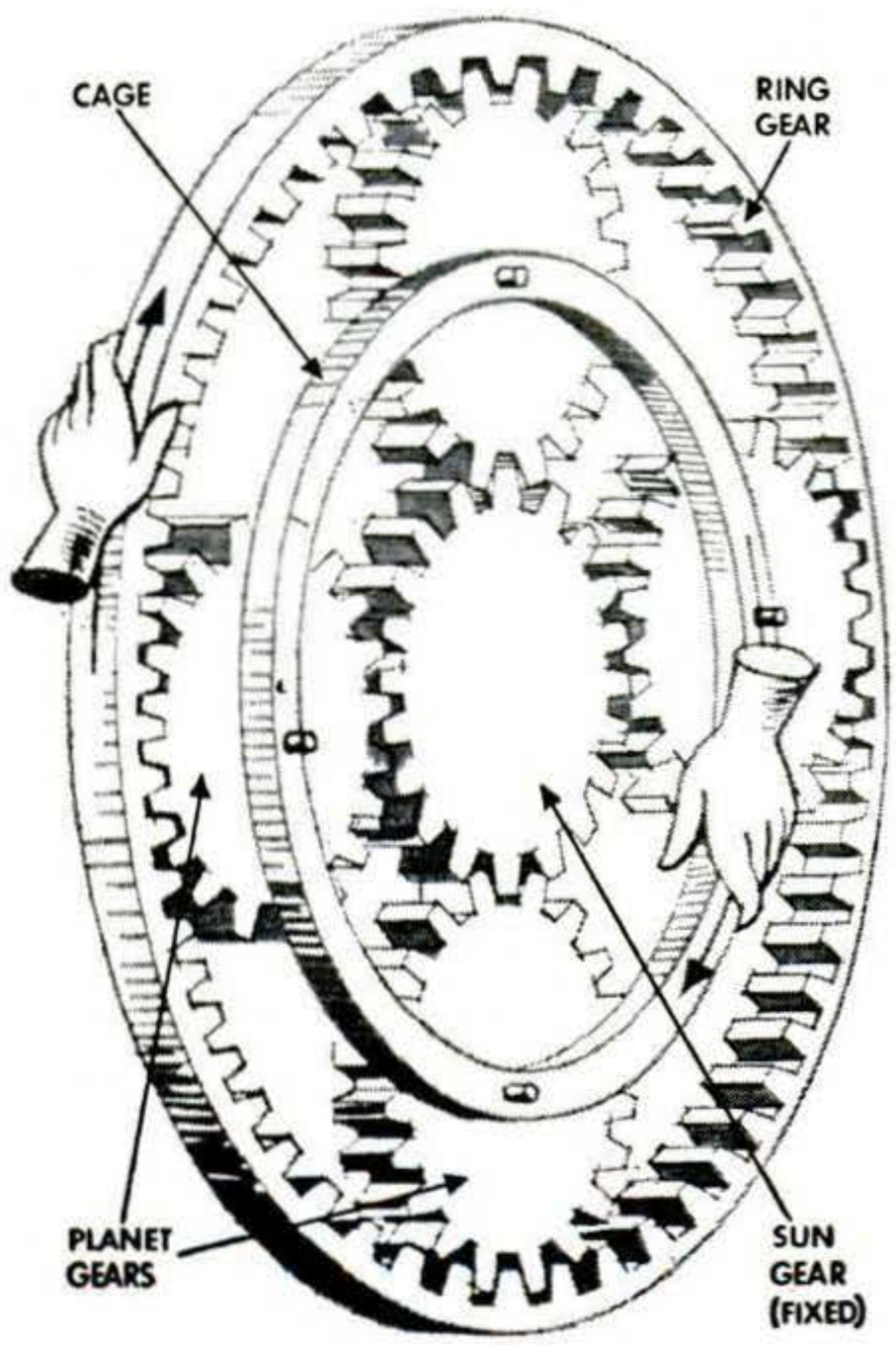
Here are a three-speed bike, its control and rear hub, and what goes on inside.



How Bike Gearshift Works

PRINCIPLE of three-speed hub is as simple as this. Turn planet gears' cage, and ring gear turns faster. Turn ring gear, and cage revolves more slowly.



BICYCLES with gearshifts now make pedal-pushing more fun and less work. Their low gear flattens out hills that you strained to climb, or walked up, with the bike you rode as a kid. In high, you fairly fly along.

U. S. pleasure cyclists currently favor a three-speed shift built into the rear hub, says the country's largest maker of bikes, Arnold, Schwinn & Co. of Chicago. A popular example is the British-made Sturmey-Archer "wide-ratio" hub, cut away above for an inside view.

To shift gears, you flick a handle-bar control lever, linked to the rear hub by a steel cable. It has three positions: "N" for normal or direct drive; "H" for high, a 33⅓-percent speed increase; "L" for low, a 25-percent decrease. Diagrams show what happens in each. A front-hub brake is hand-operated.

Other bike gearshifts include one newly introduced by Bendix, with high-low gear and foot brake both in rear hub. A French design shifts one or more drive chains between different sprockets.

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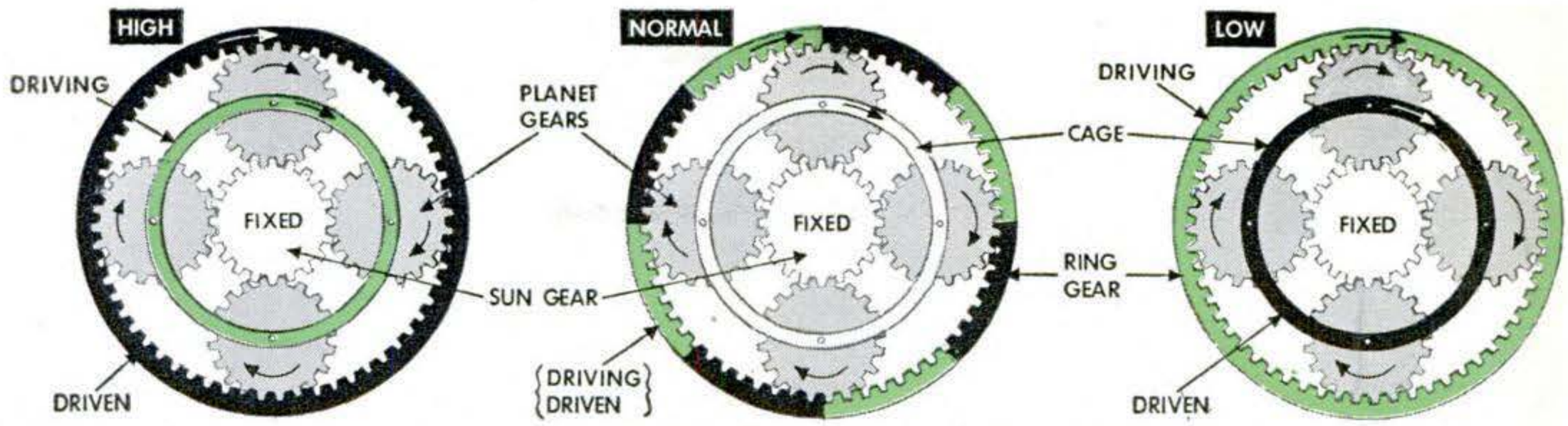
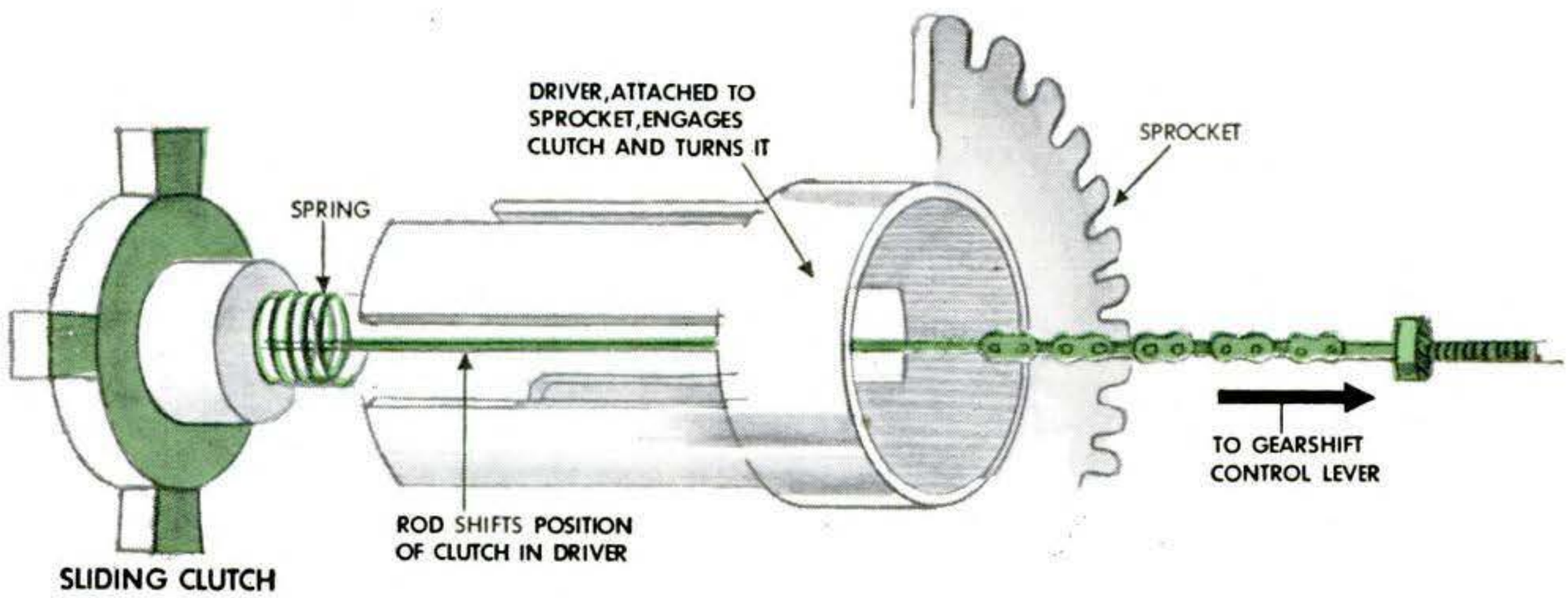


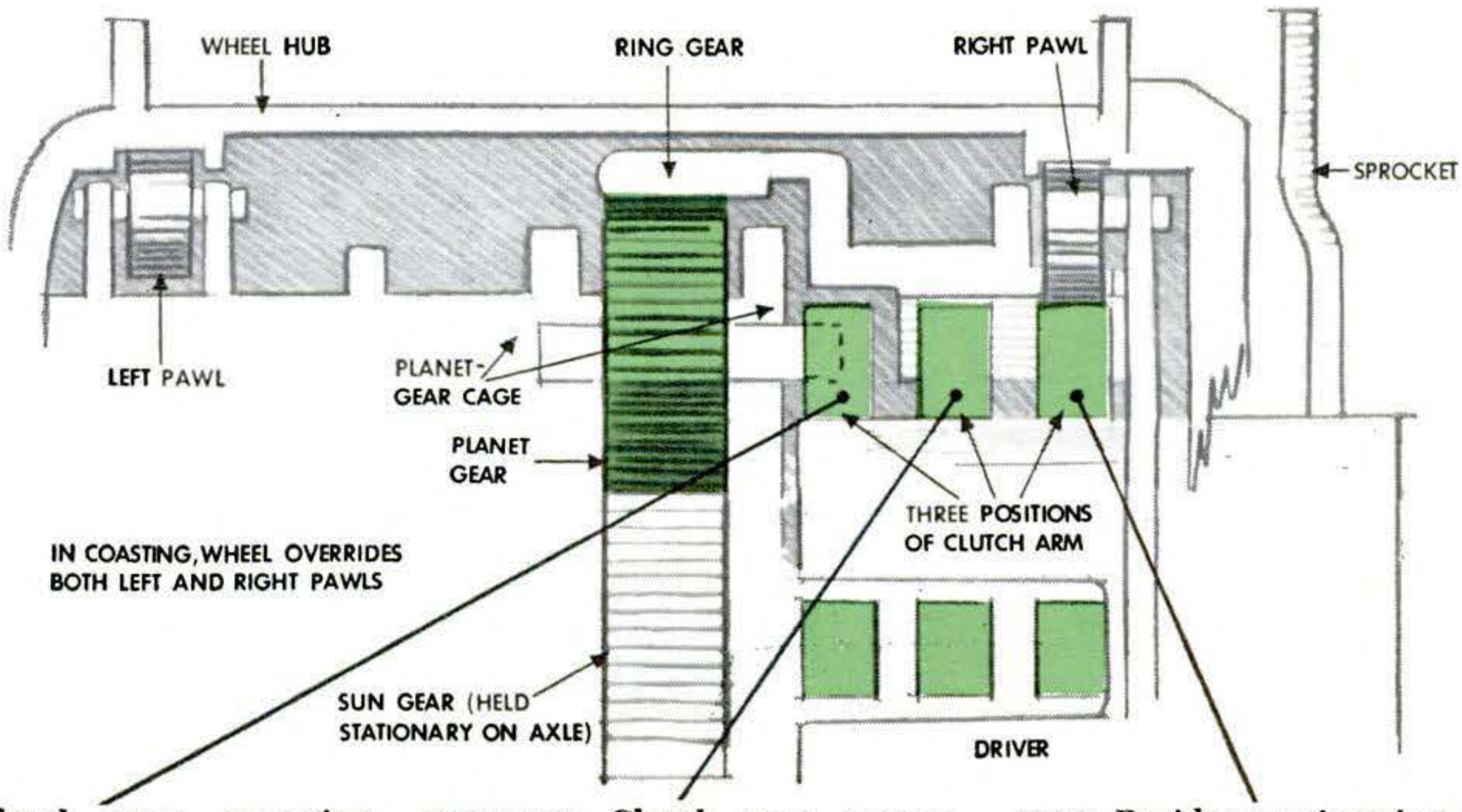
REAR WHEEL makes four turns to sprocket's three, with sprocket connected to planet-gear cage; the wheel, to ring gear.

DIRECT DRIVE connects both sprocket and rear wheel to ring gear, so that they turn at the same rate. Planet gears idle.

SPROCKET turns four times to wheel's three with sprocket connected to ring gear, rear wheel to planet-gear cage.



TRICK OF MAKING desired connections between sprocket, gears and wheel is brought off by sliding clutch. It fits into slotted driver shown beside it. Control cable and rod pull the four-armed clutch toward right, against pressure of spring that returns it when cable is slackened. What the clutch does in each of its three positions is shown in the diagram below.



HIGH: Clutch arms, engaging planet gears' axles, turn their cage. Planet gears drive ring gear; and, through right pawls, the rear wheel. (Wheel overrides left pawls on the slower-turning gear cage.)

NORMAL: Clutch arms engage ring gear and turn it, driving the rear wheel directly through right pawls. Planet gears are turning, too, but are simply idling. (Again, wheel overrides left pawls on gear cage.)

LOW: Besides turning ring gear, clutch arms depress right pawls, disengaging them from wheel. Ring gear drives planet gears and cage; and left pawls, coming into use for first time, turn the bike's rear wheel.

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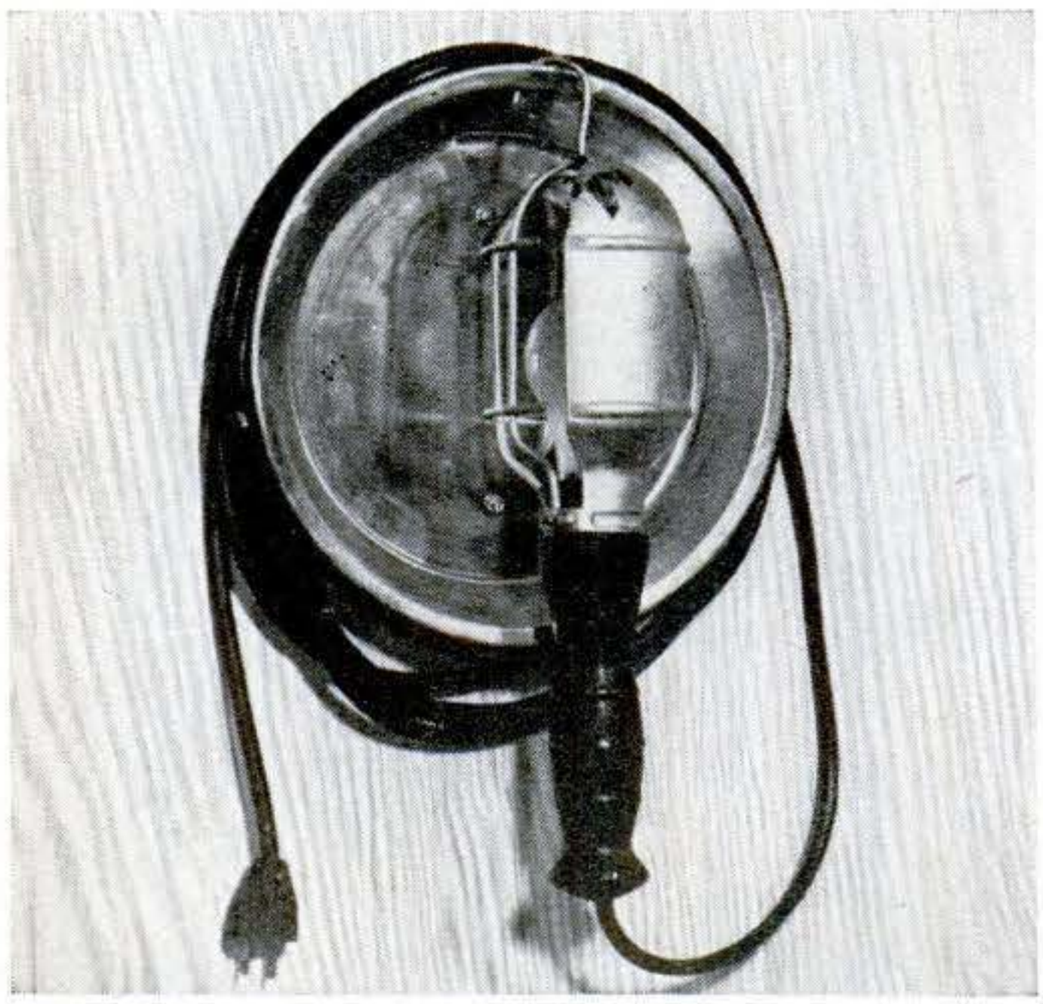
These Eggshells Hatch Plants

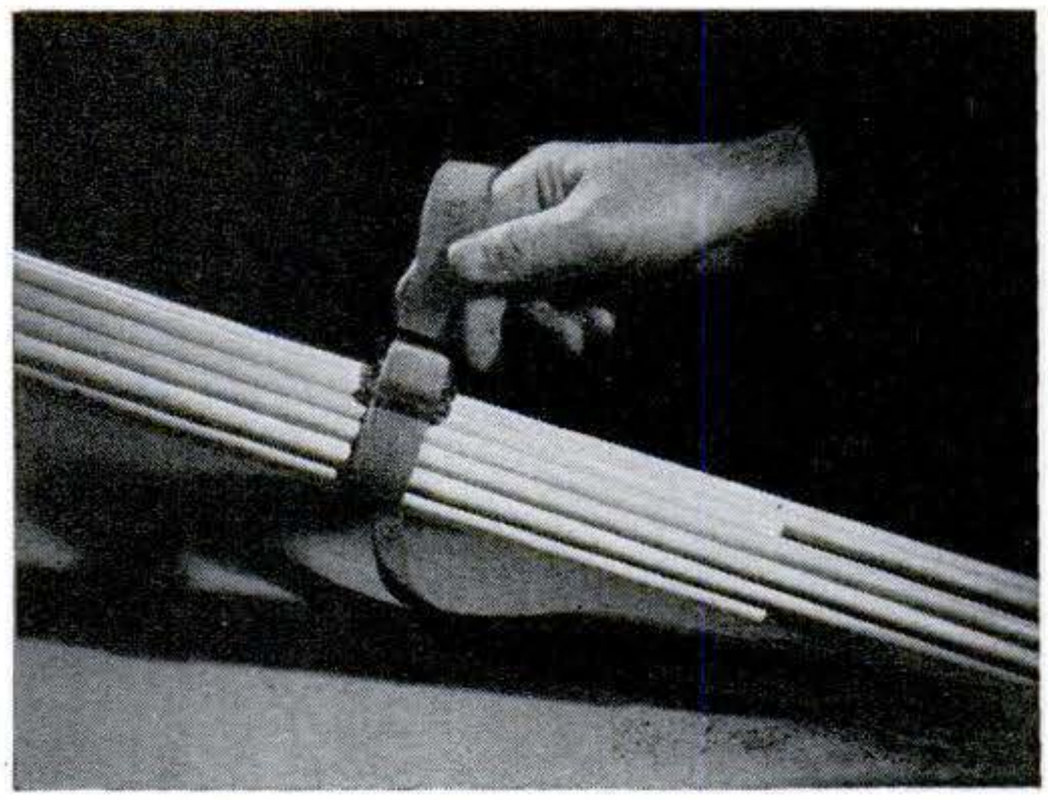
THE kitchen queen in our house does her spring planting in eggshells carefully saved from the breakfast ham and eggs.

Each egg is cracked sharply to preserve one or both halves of the shell. Into each half goes a little earth, then a seed or two. They are put back in the sectional egg box and set in a sunny kitchen window. When the seedlings sprout out, they are transplanted in the garden, shell and all, with their own built-in lime supply.—*B. Keith, Ottawa, Canada.*



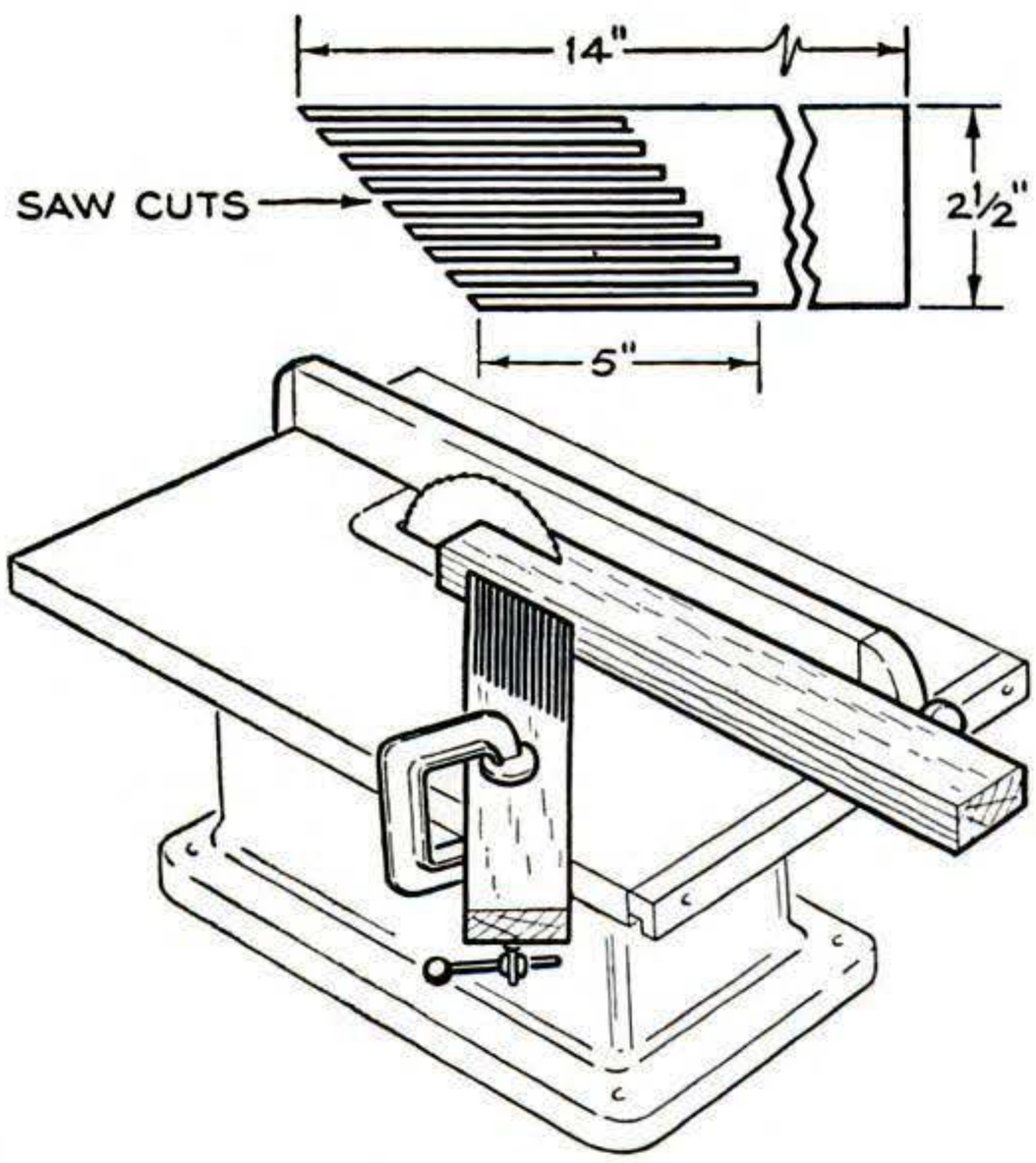
Pie Tin Holds Trouble Light

A METAL pie pan mounted on a closet or basement wall will keep a trouble light handy for use when you need it. The bulb-guard hook is slipped through a hole punched in the rim, while the extension cord is wrapped neatly around the pan.—*Norm Jacky, Fond du Lac, Wis.*



Strap Keeps Dowels in Bundle

ONE or two web book straps will hold your assortment of dowels in a neat bundle between projects. The sliding buckles are easily tightened as dowels are removed for use.—*Ken Murray, Colon, Mich.*



Pressure Block Guards Fingers

CLOSE-GRAINED hardwood—especially hickory, ash or maple—can be made into a handy pressure block to hold stock firmly against the fence of a table saw, joiner or shaper. Make a 45° cut at one end of the block; then saw a number of close-spaced cuts lengthwise from this end a distance of 5″. Attach the block to the table with a C clamp so that the slotted end presses against the stock to be cut.

The springy prongs will hold the stock securely against the fence and still allow it to be moved against the cutting tool.—*Arthur L. Kaser, Niles, Mich.*

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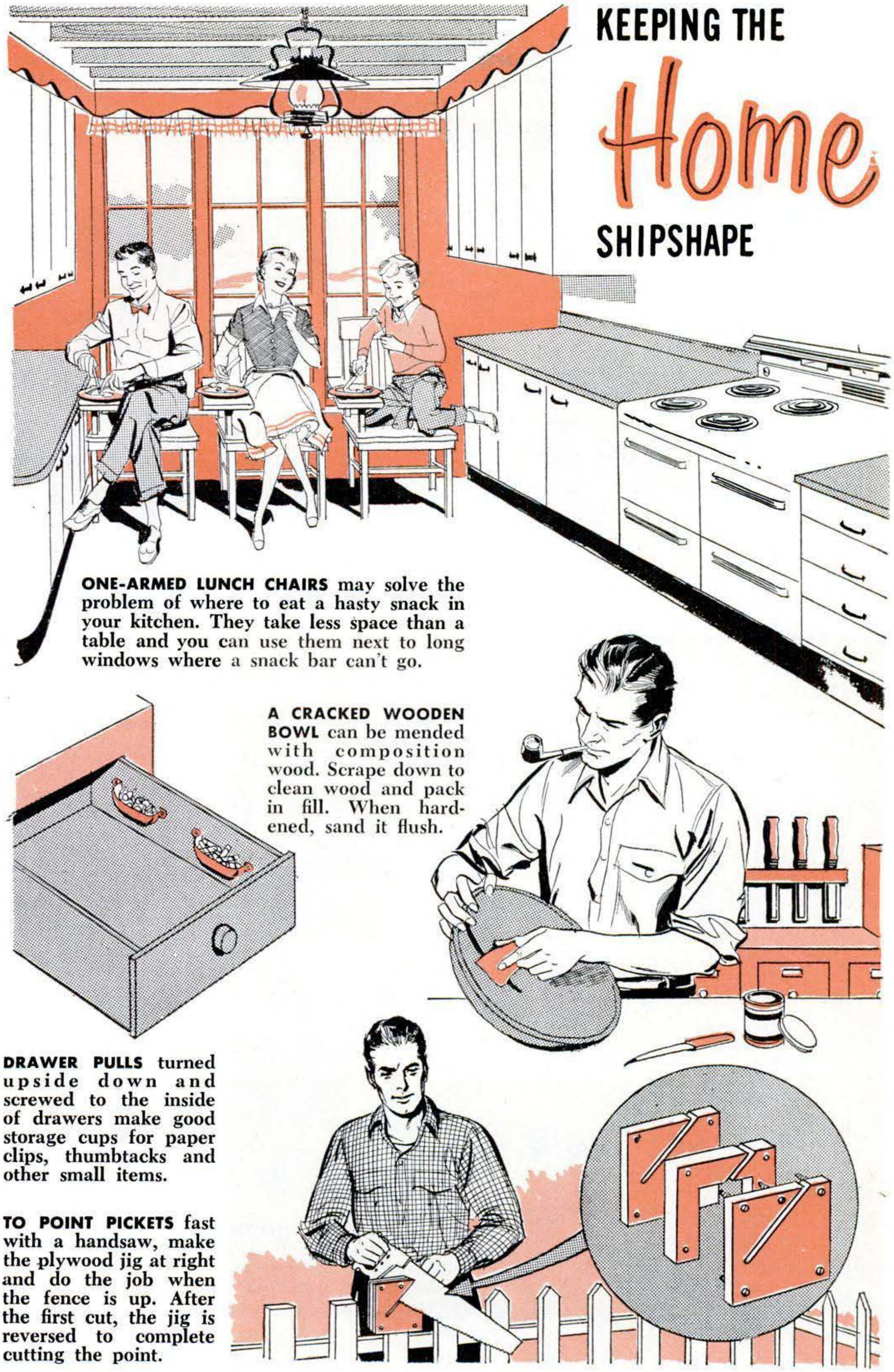
KEEPING THE *Home* SHIPSHAPE



ONE-ARMED LUNCH CHAIRS may solve the problem of where to eat a hasty snack in your kitchen. They take less space than a table and you can use them next to long windows where a snack bar can't go.

A CRACKED WOODEN BOWL can be mended with composition wood. Scrape down to clean wood and pack in fill. When hardened, sand it flush.

DRAWER PULLS turned upside down and screwed to the inside of drawers make good storage cups for paper clips, thumbtacks and other small items.

TO POINT PICKETS fast with a handsaw, make the plywood jig at right and do the job when the fence is up. After the first cut, the jig is reversed to complete cutting the point.

Please turn the page for more home tips

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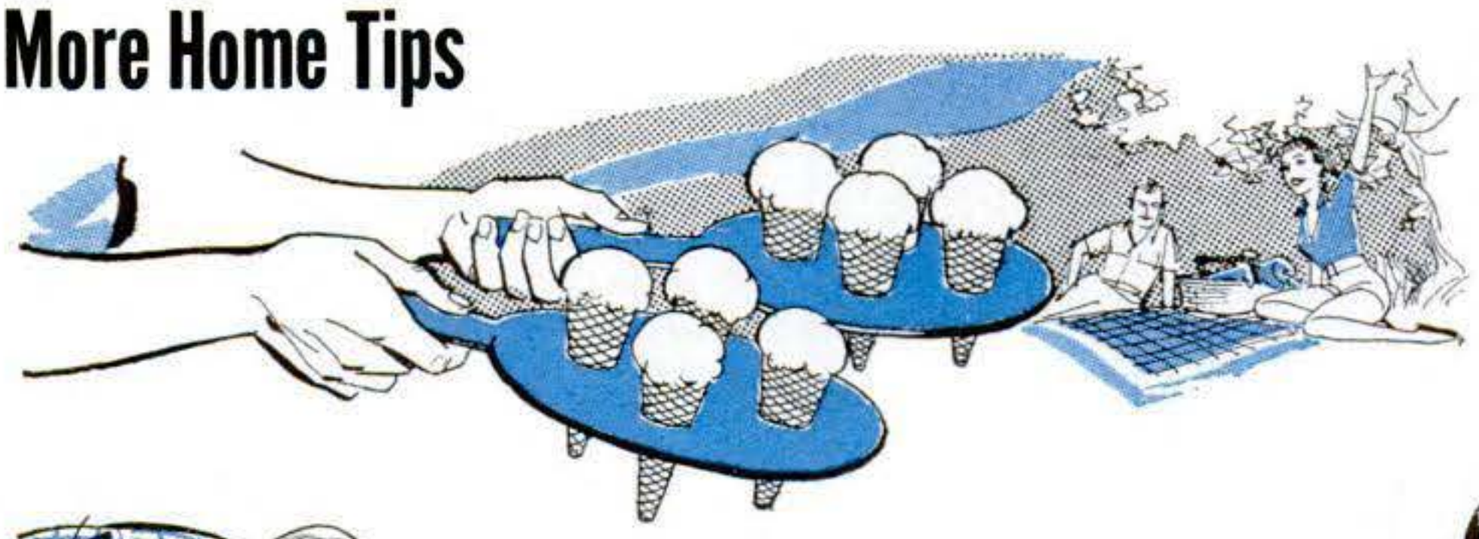
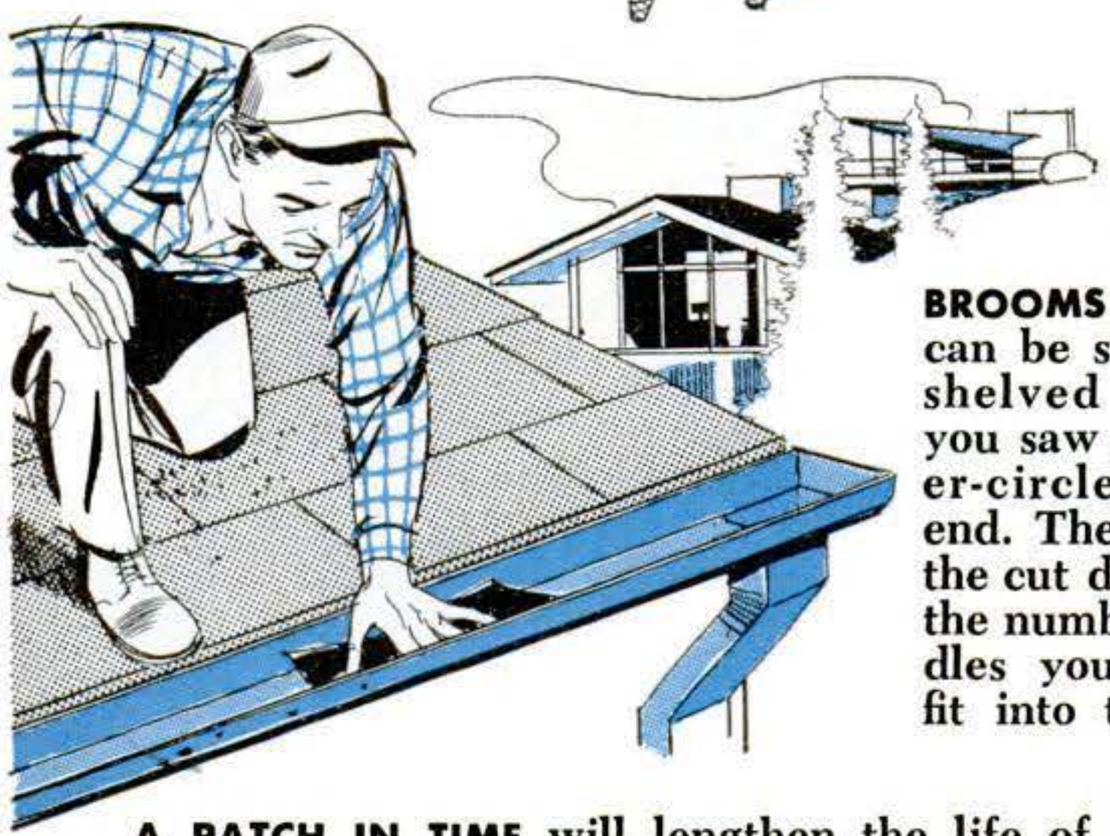
More Home Tips



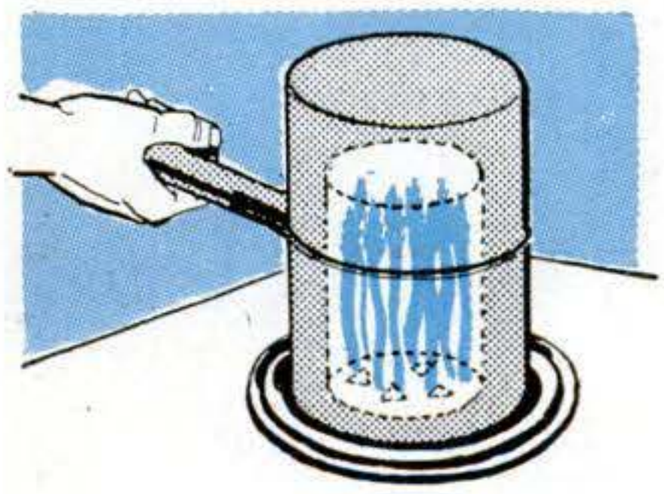
ICE-CREAM CONES can be carried without juggling in paddles like these. Make them of scrap hardboard or plywood and cut the holes with an expansion bit.

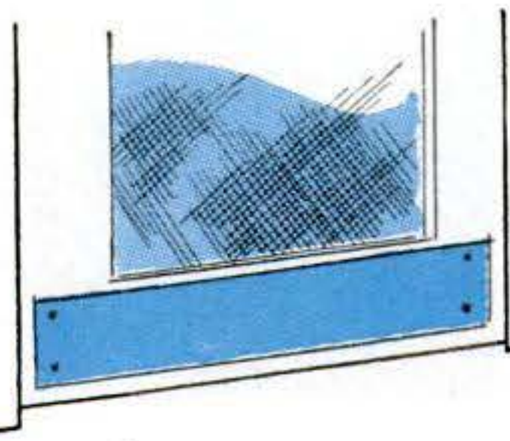


A PATCH IN TIME will lengthen the life of your roof gutters. Coat any damaged spots with roofing cement and apply patches cut from a piece of building paper.

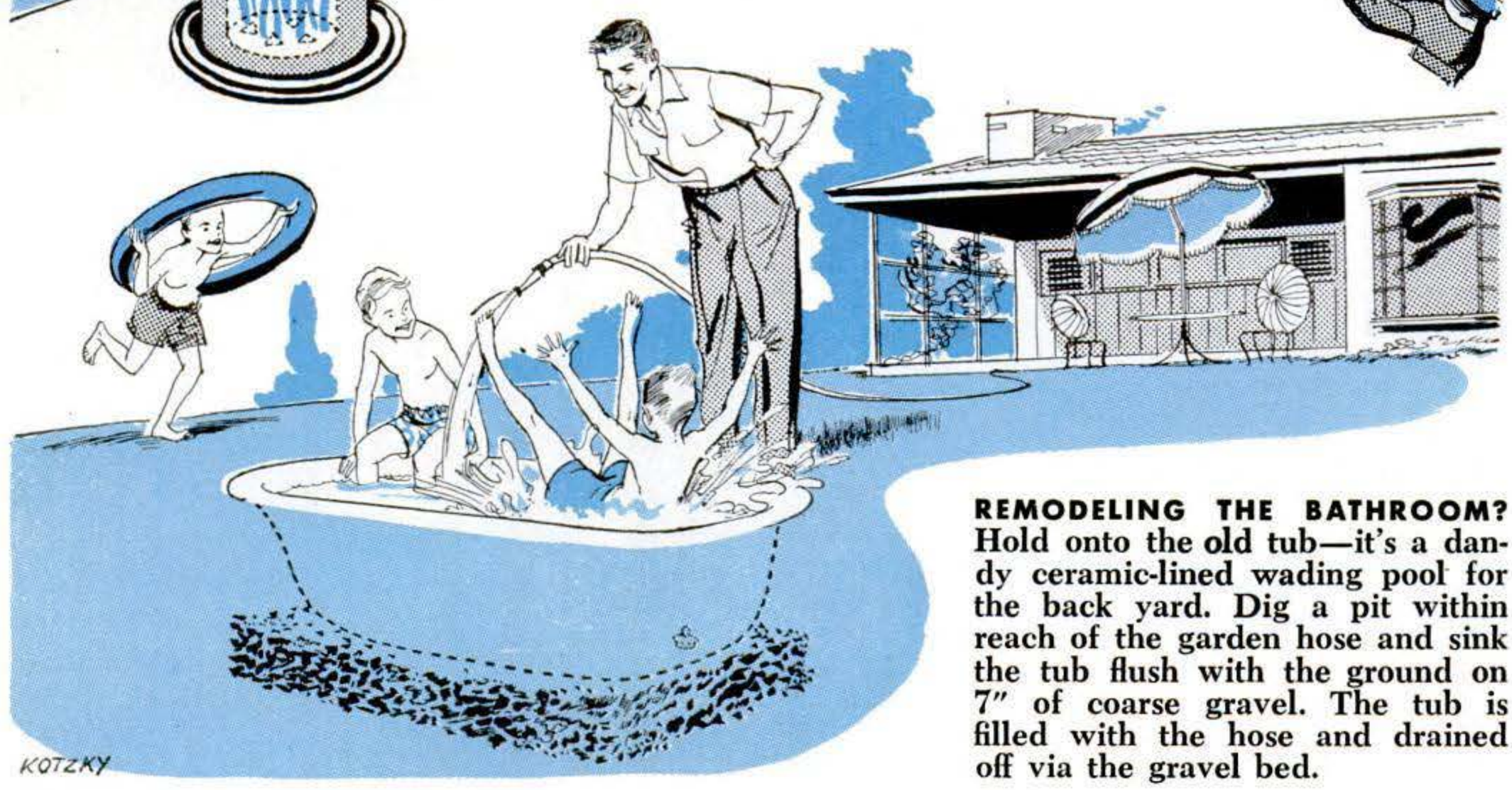
BROOMS AND MOPS can be stored in a shelved closet if you saw out quarter-circles at one end. The radius of the cut depends on the number of handles you want to fit into the curve.

TO STEAM ASPARAGUS, tips up, try a double boiler with the top pot inverted. Pack the spears in a can cut through at the bottom with a beer-can opener to make the needed water inlets.





LEFTOVERS OF LINOLEUM or tile cut into strips make a good kick panel for a screen door. A quick swipe with a damp cloth wipes off any unsightly scuff marks.



REMODELING THE BATHROOM? Hold onto the old tub—it's a dandy ceramic-lined wading pool for the back yard. Dig a pit within reach of the garden hose and sink the tub flush with the ground on 7″ of coarse gravel. The tub is filled with the hose and drained off via the gravel bed.

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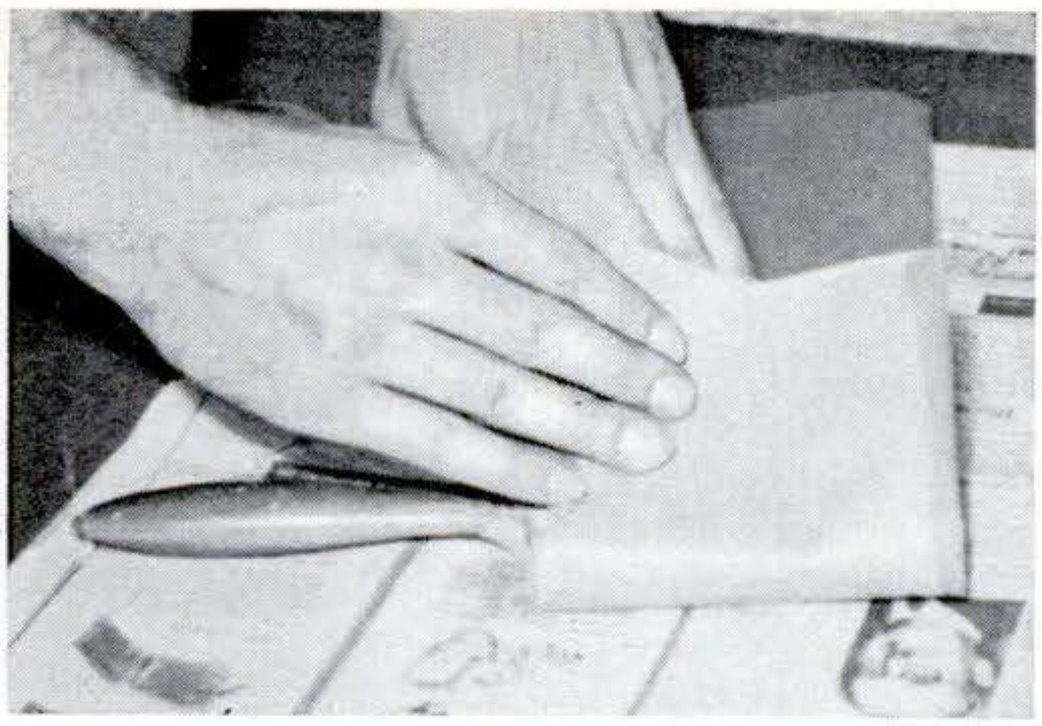
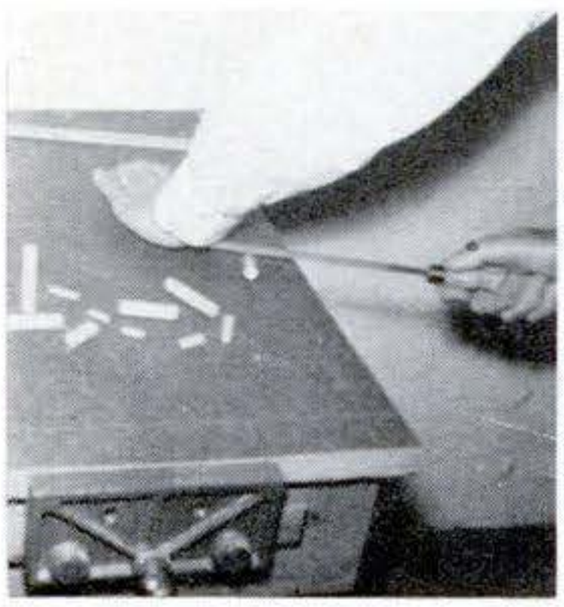


How to Break In a Paintbrush

A NEW paintbrush should be broken in if you are to get the best service from it. Knock out loose bristles by slapping it across the spread fingers of your hand. Then wrap it in heavy paper and soak in linseed oil at least 12 hours. Suspend the wrapped brush in a covered container so the end just touches the bottom. The oil should come a little above the paper.



Knurled Dowels Improve Joints

INDENTED dowels give you a stronger joint by providing extra gluing surface. Cut the dowels to required length; then roll each under a file with sufficient pressure to knurl the surface. Extra pressure at the ends will produce a slight taper for easier fitting in holes.—*C. C. Whittaker, Pittsburgh.*

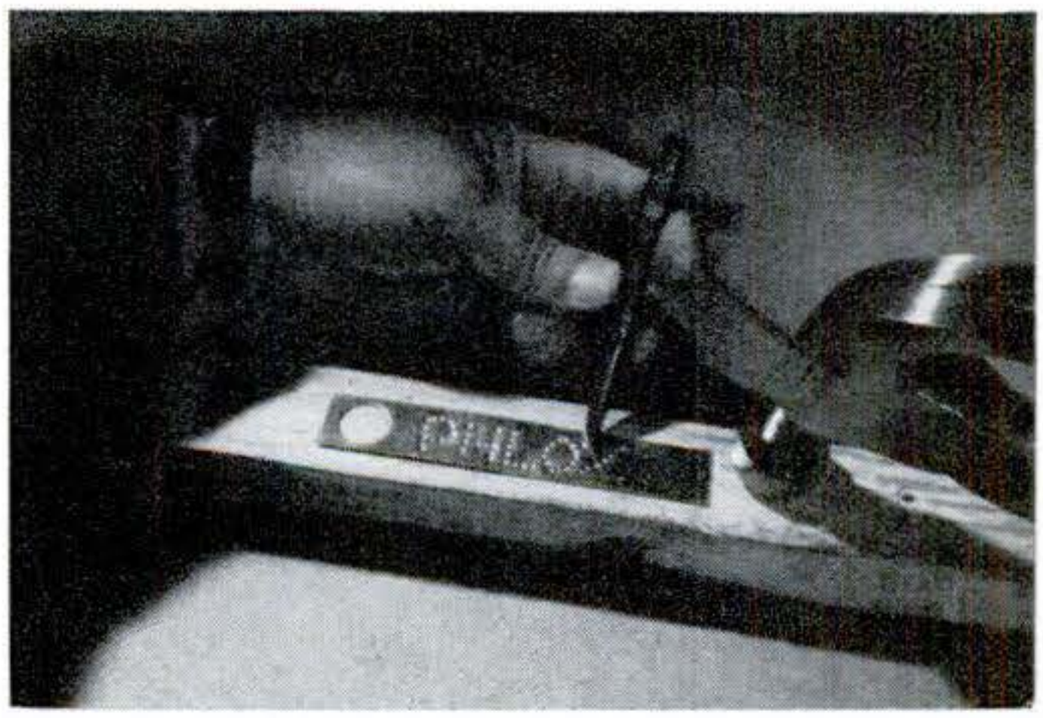
Oil Kept in Multiple Supply

OLD lighter-fluid cans refilled with oil help keep tools and machines lubricated by providing a ready supply at the time and place you need it. Cans having plastic spouts are refilled easily by forcing the spout off the neck. Use them for various grades of oil and other liquids doled out in small quantities or in tight spots, and keep one in every place where it will be handy.—*A. Katell, Wantagh, N. Y.*

Binder Files Appliance Data

THE habit of inserting in a ring binder literature received with home appliances will give you a ready-reference file. It will make it easy to find instruction sheets when repairs are necessary.

Besides saving time, such an encyclopedia will tell you what and how to order should the vacuum cleaner need a belt, the oil burner a screen or the drapery rods a cord.—*Michael Ligocki, Gary, Ind.*



Garden Tags Made Permanent

IDENTIFICATION of flowers and vegetables is simplified by tags which you can cut from tin-can stock and use from year to year. Mark plant names with a prick punch. Varnish to forestall rusting or color-code with thin enamel for recognition at a glance. —*Ken Murray, Colon, Mich.*

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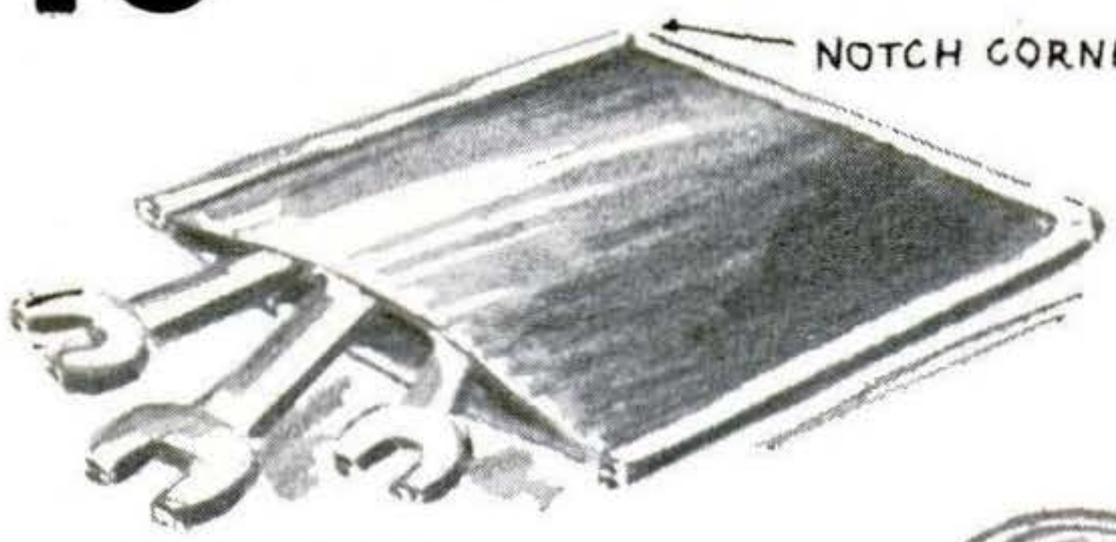
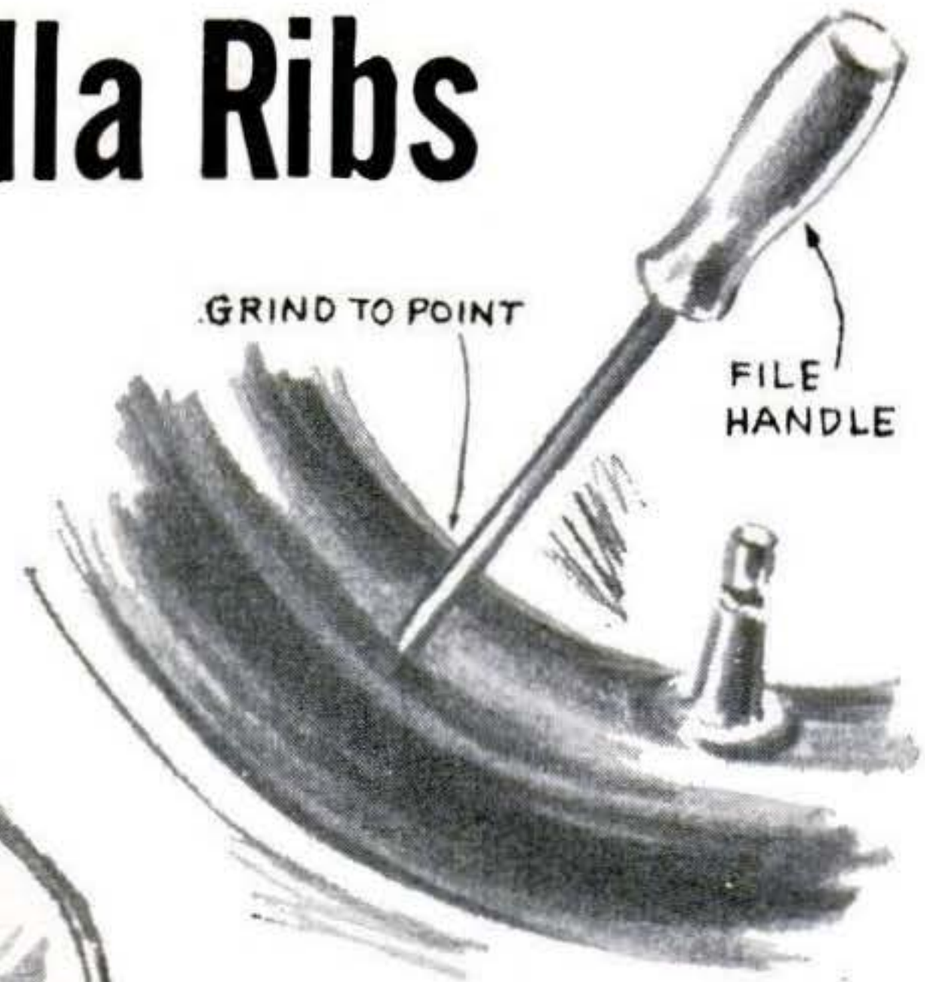
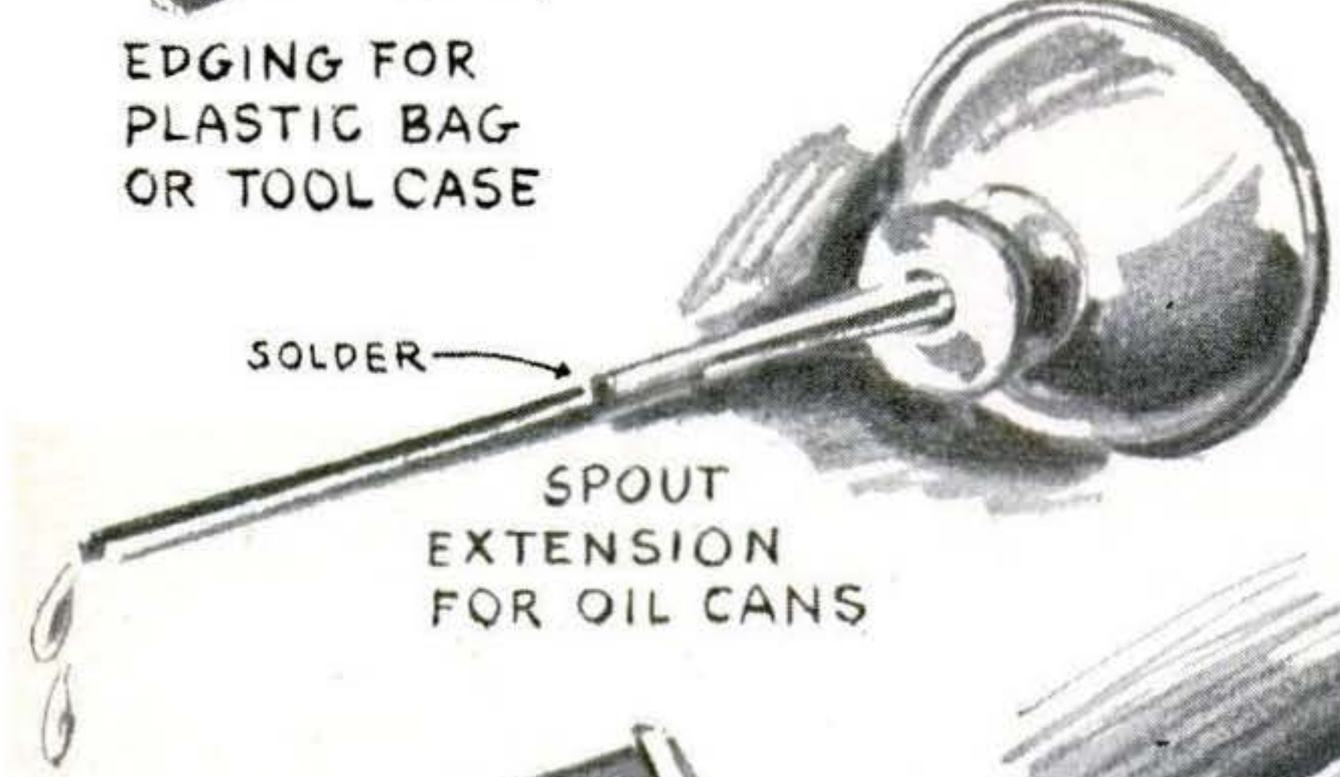
15 USES FOR Umbrella Ribs



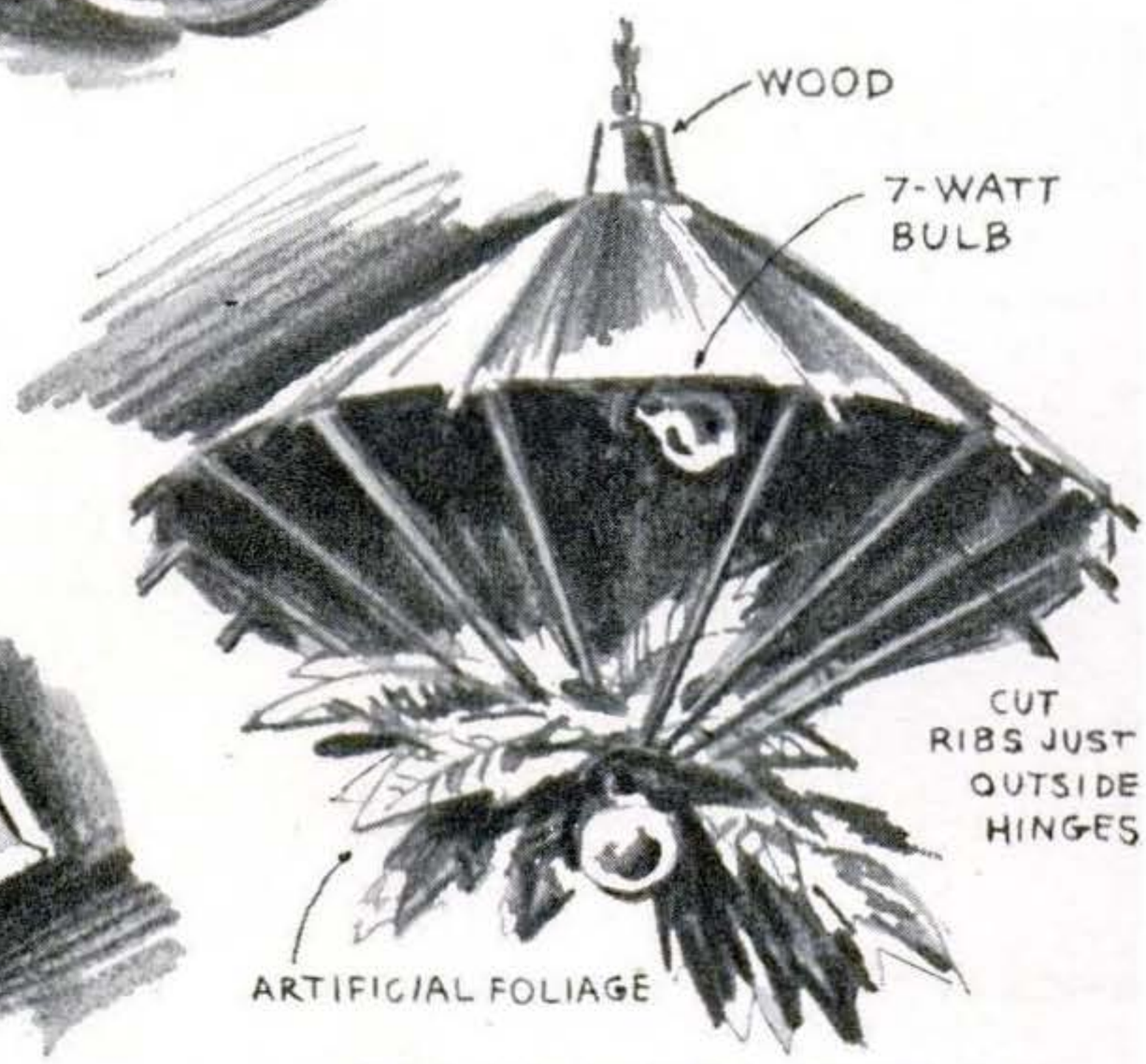
EDGING FOR PLASTIC BAG OR TOOL CASE



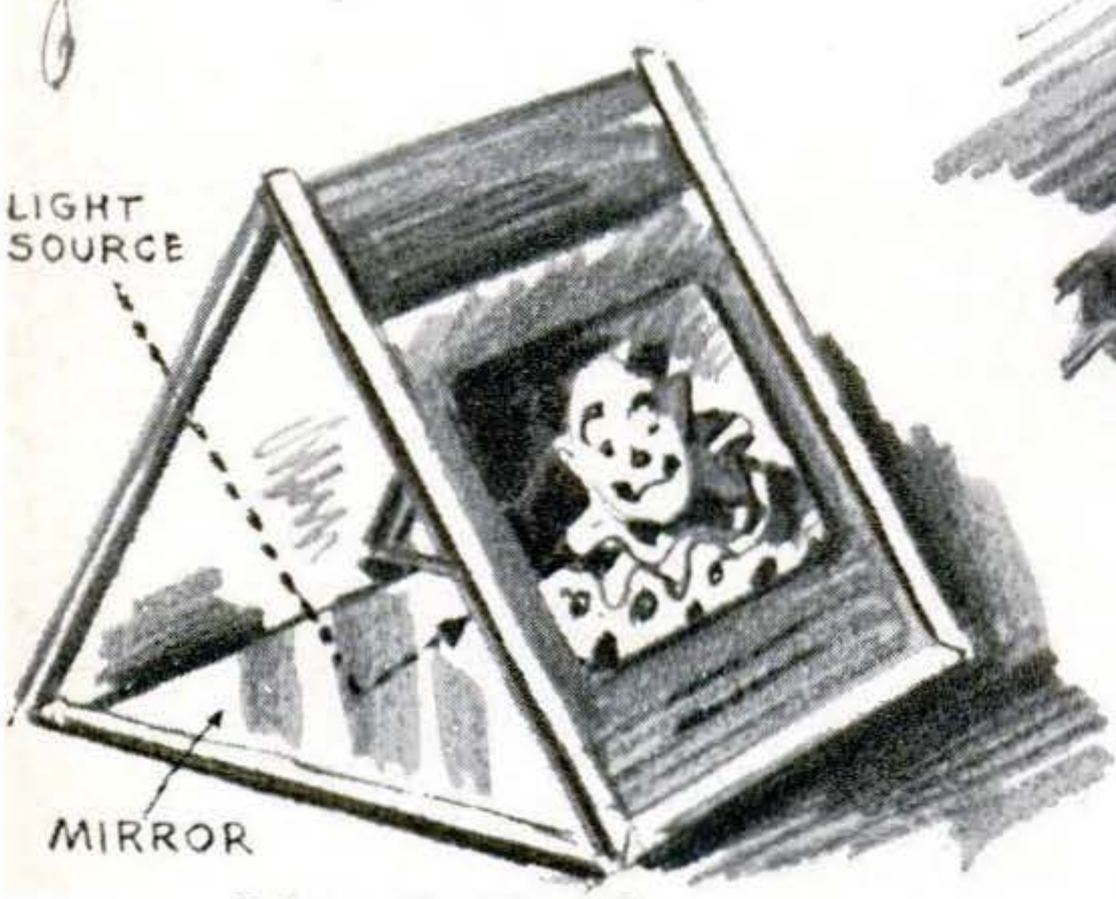
PUNCTURE MARKER AND DEFLATOR



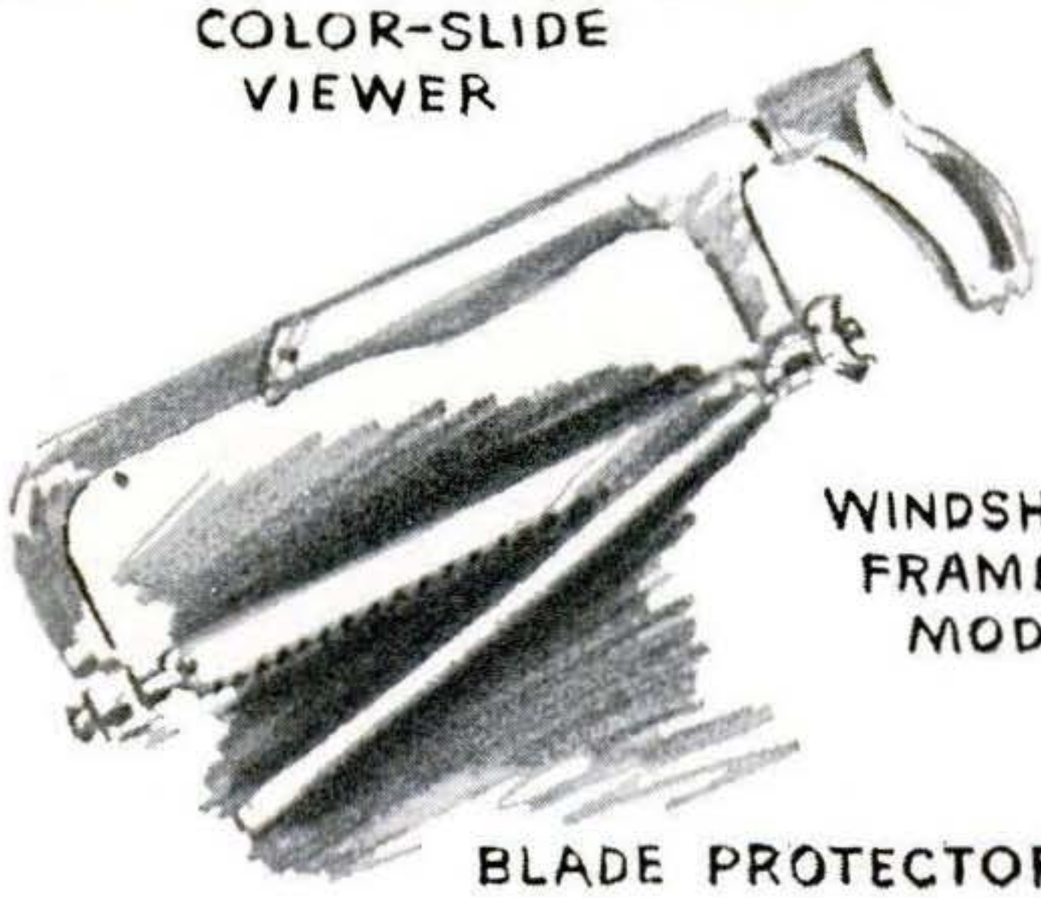
SPOUT EXTENSION FOR OIL CANS



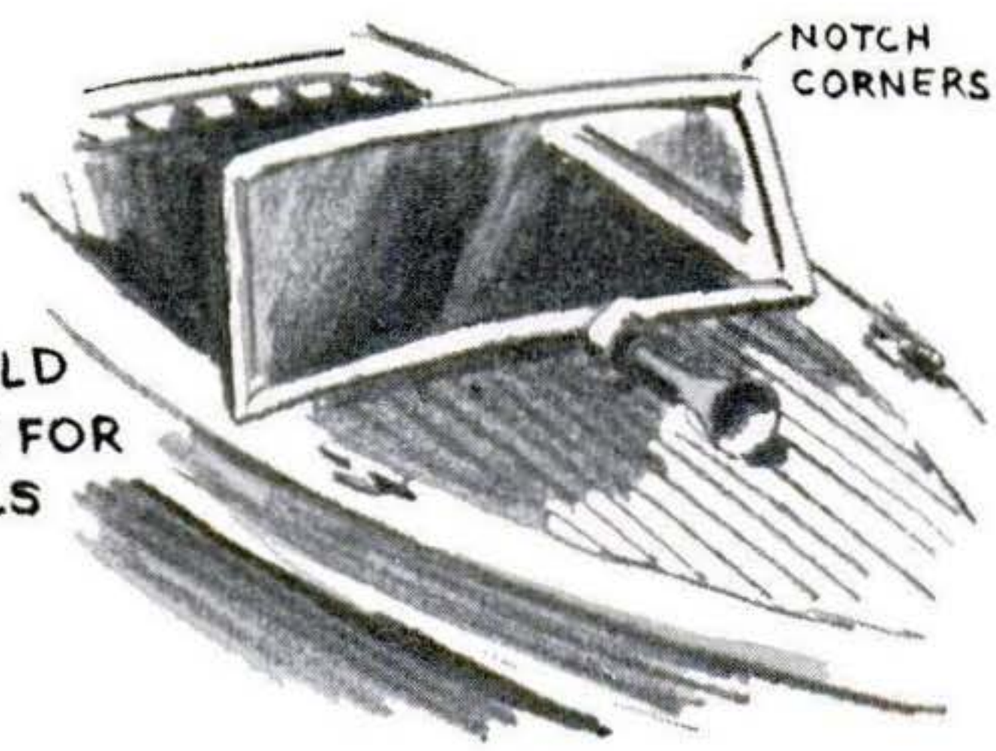
ORNAMENTAL FIXTURE



COLOR-SLIDE VIEWER



BLADE PROTECTOR



WINDSHIELD FRAMES FOR MODELS

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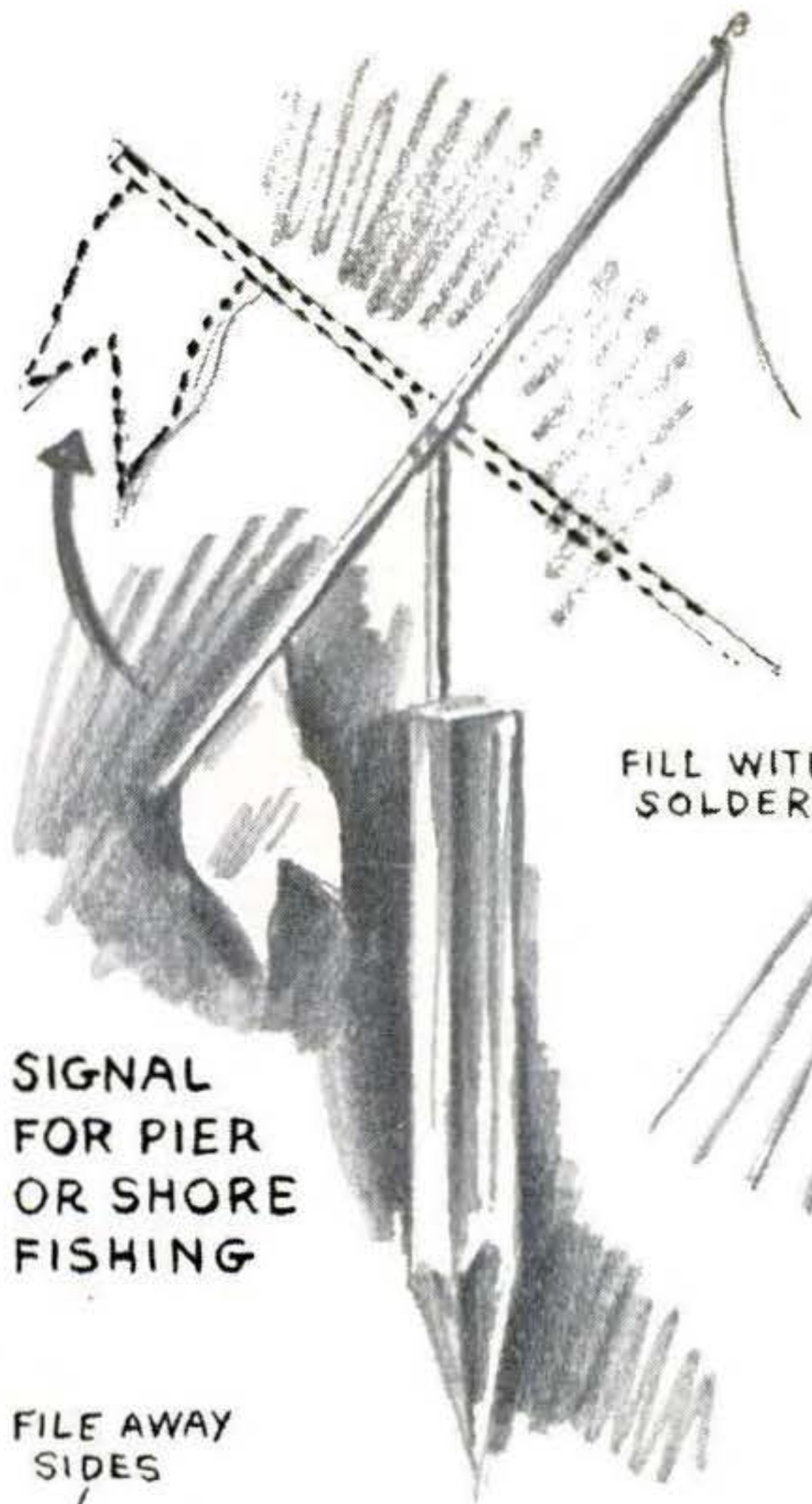
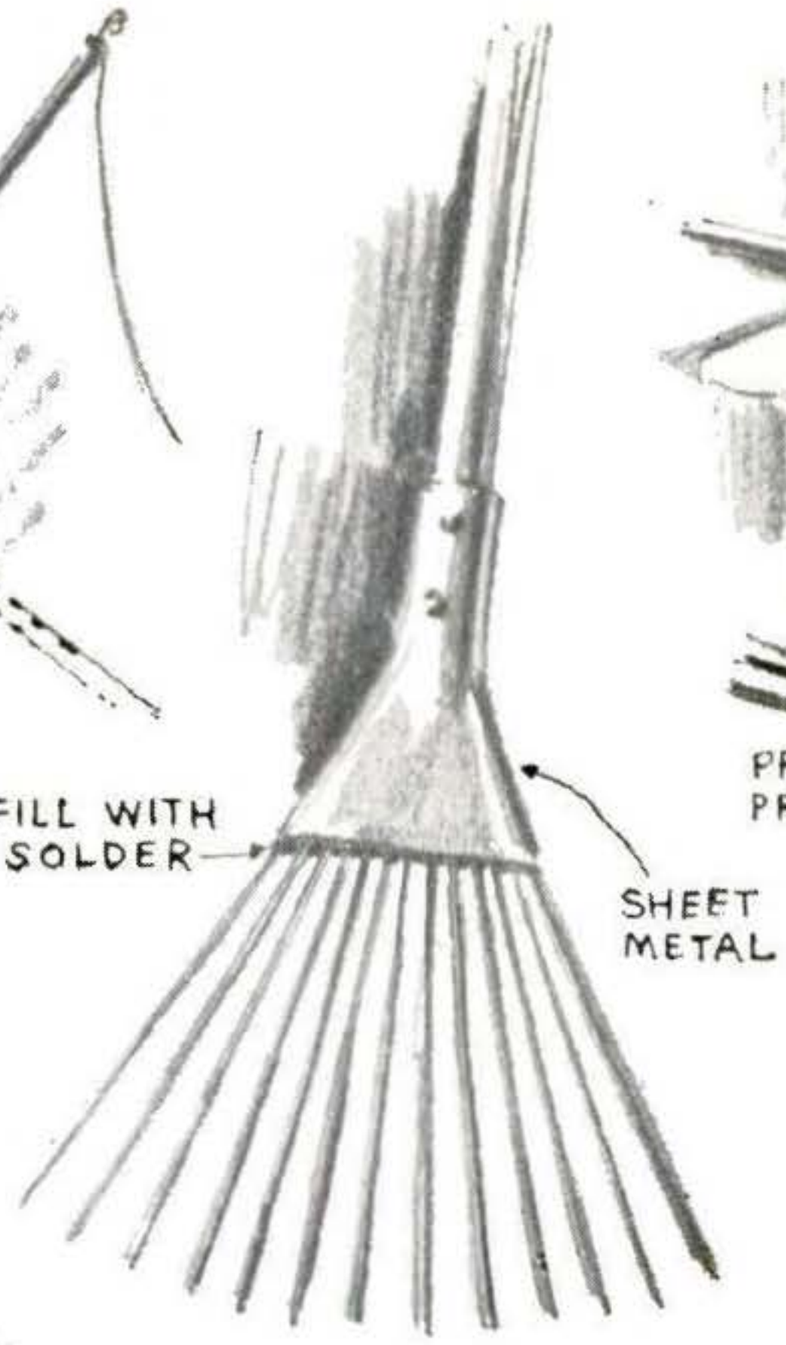
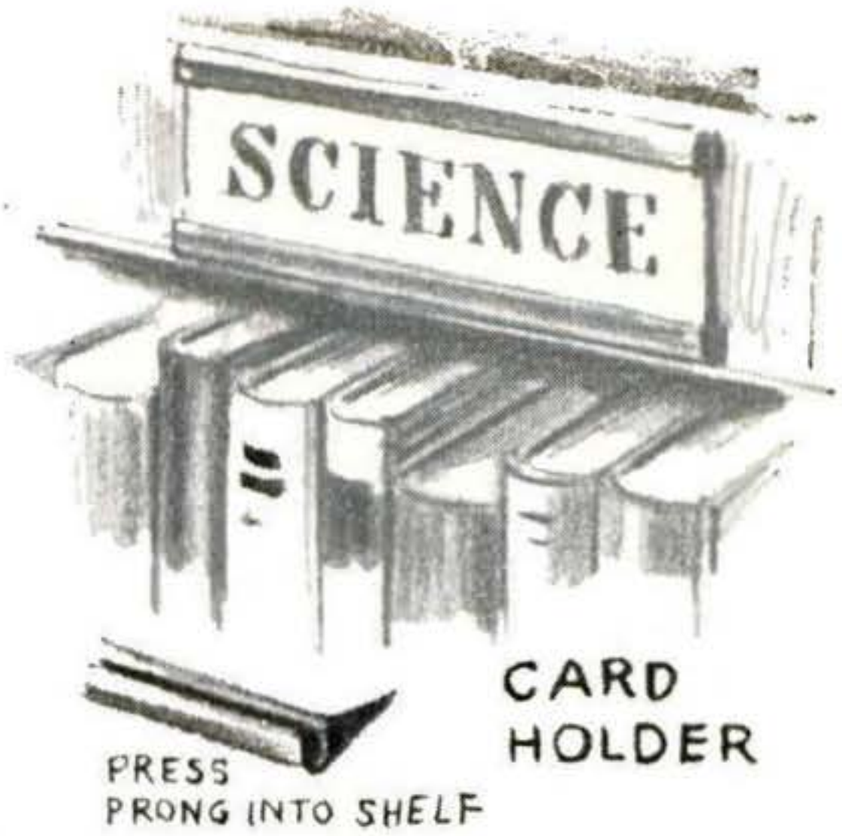


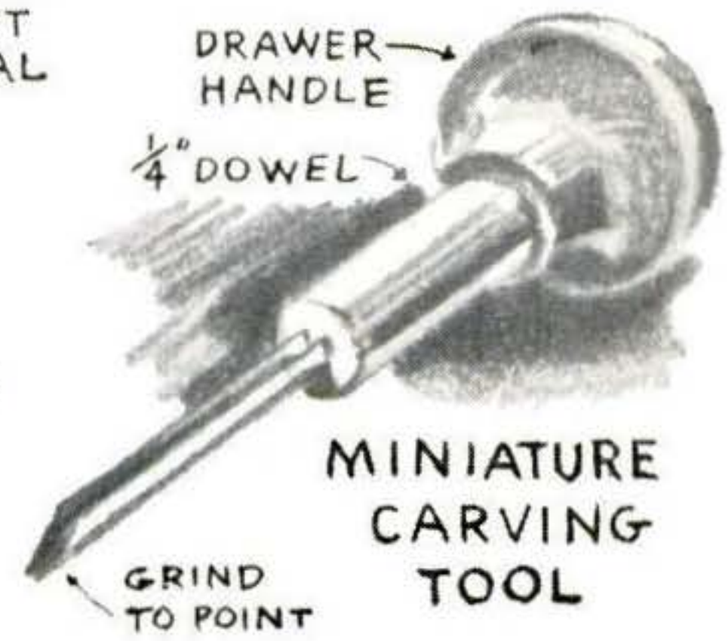
SIGNAL FOR PIER OR SHORE FISHING



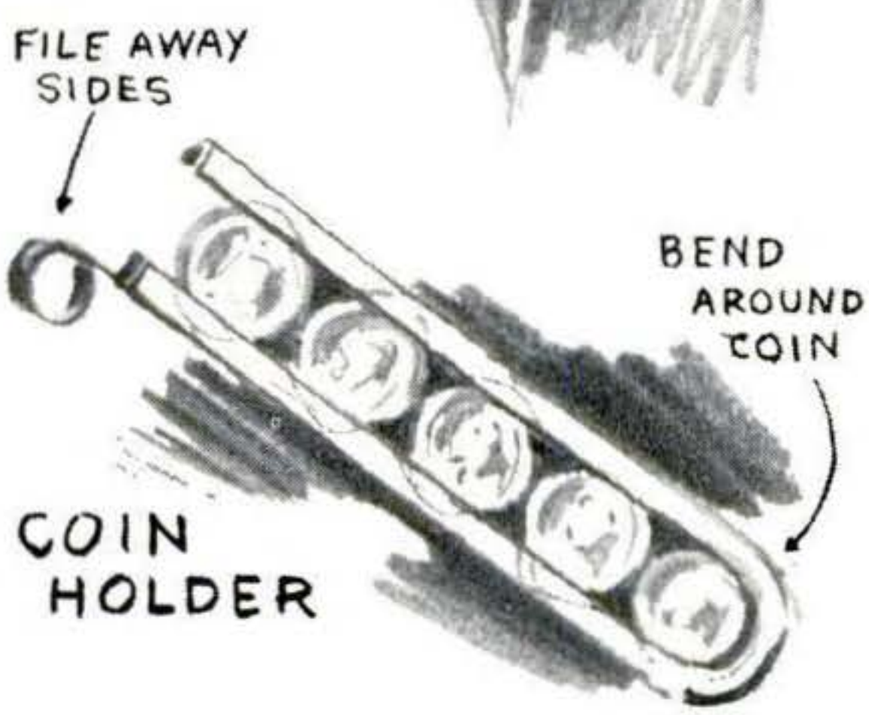
LAWN RAKE



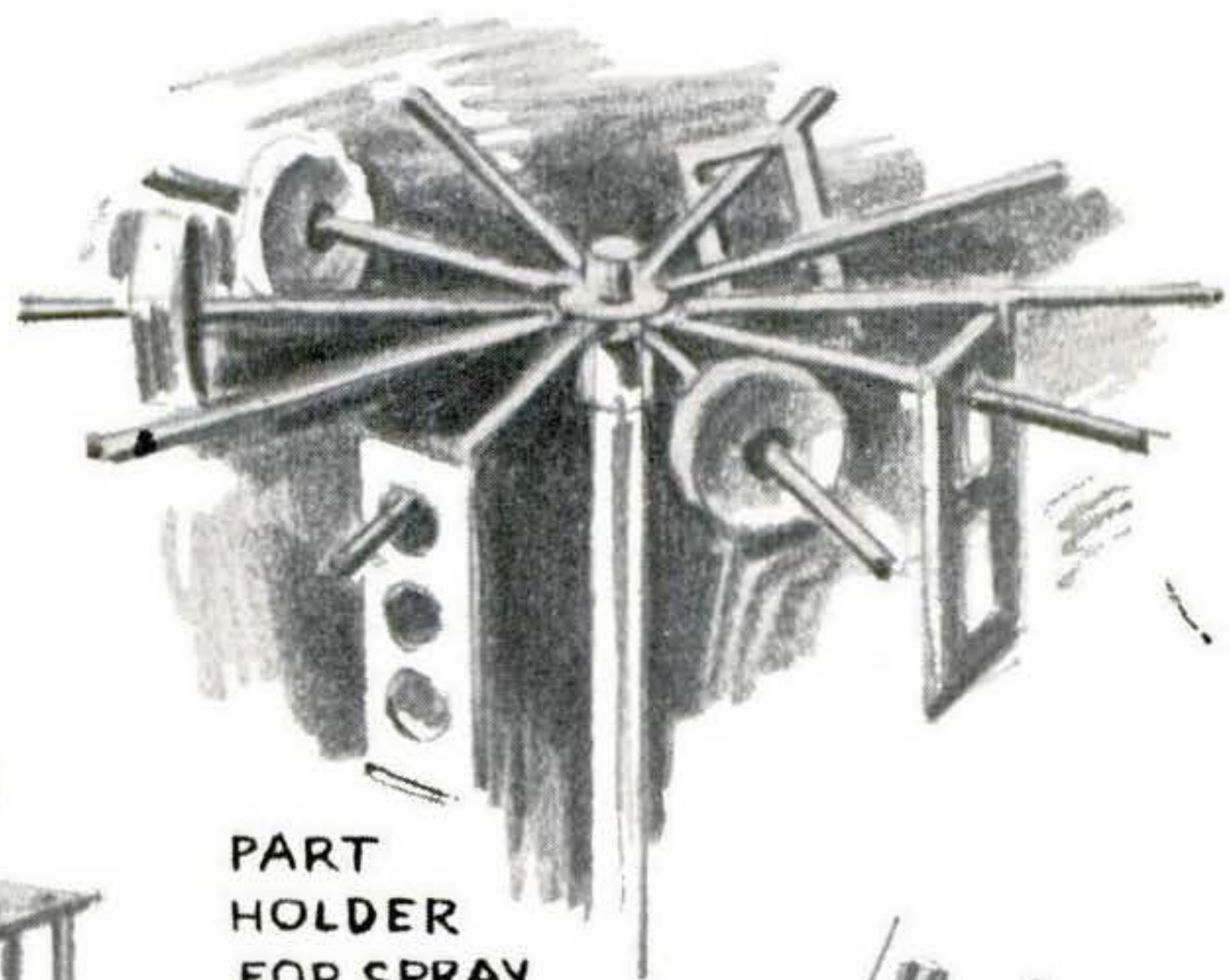
CARD HOLDER



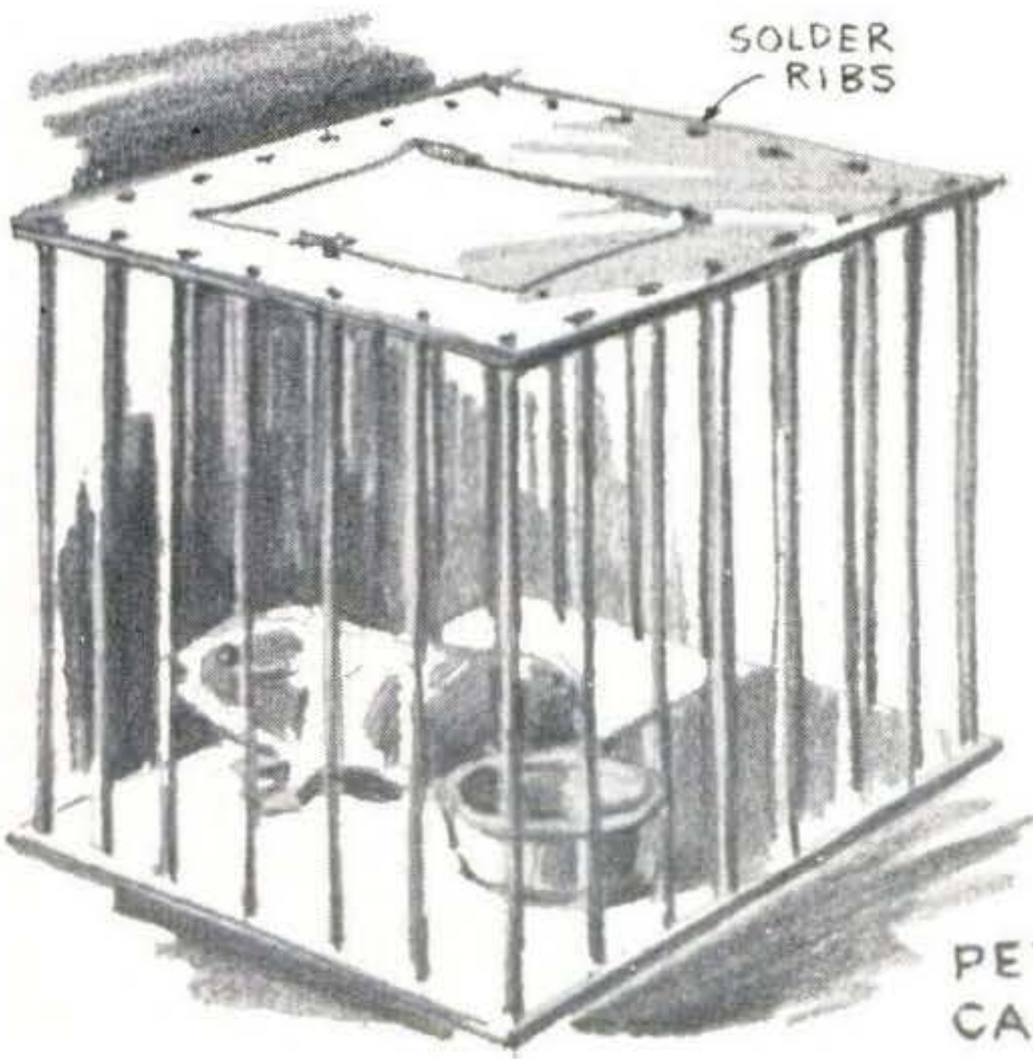
MINIATURE CARVING TOOL



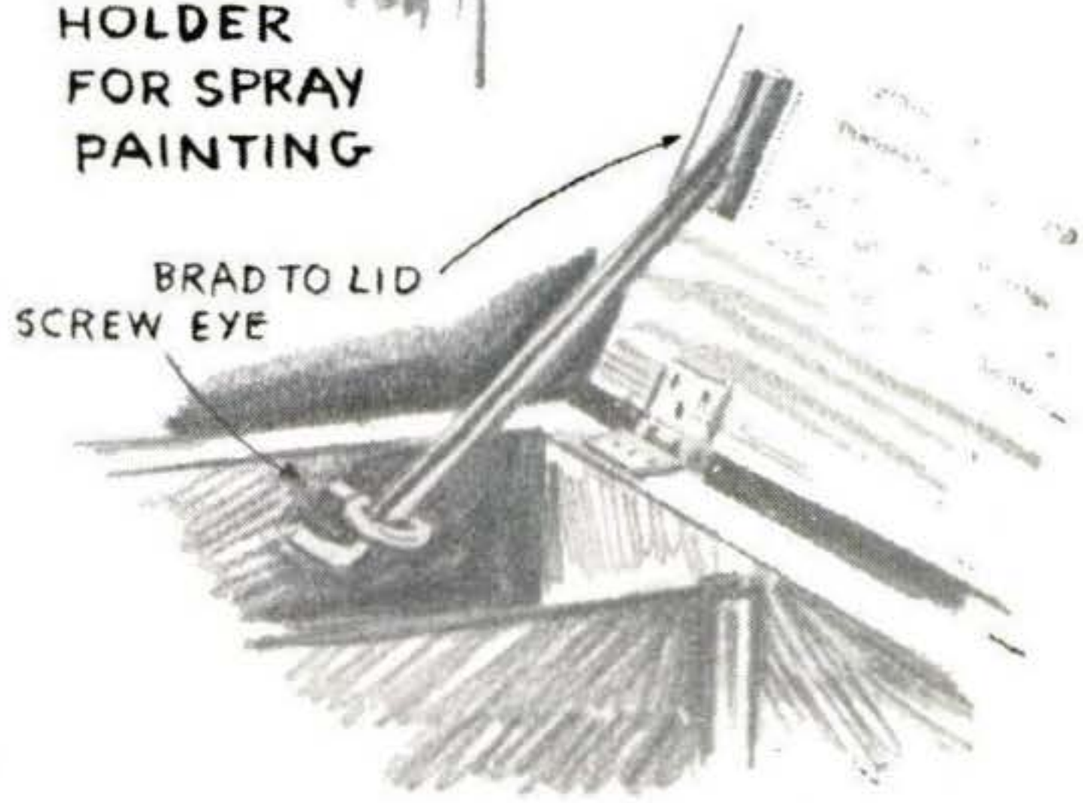
COIN HOLDER



PART HOLDER FOR SPRAY PAINTING



PET CAGE



BOX FITTINGS

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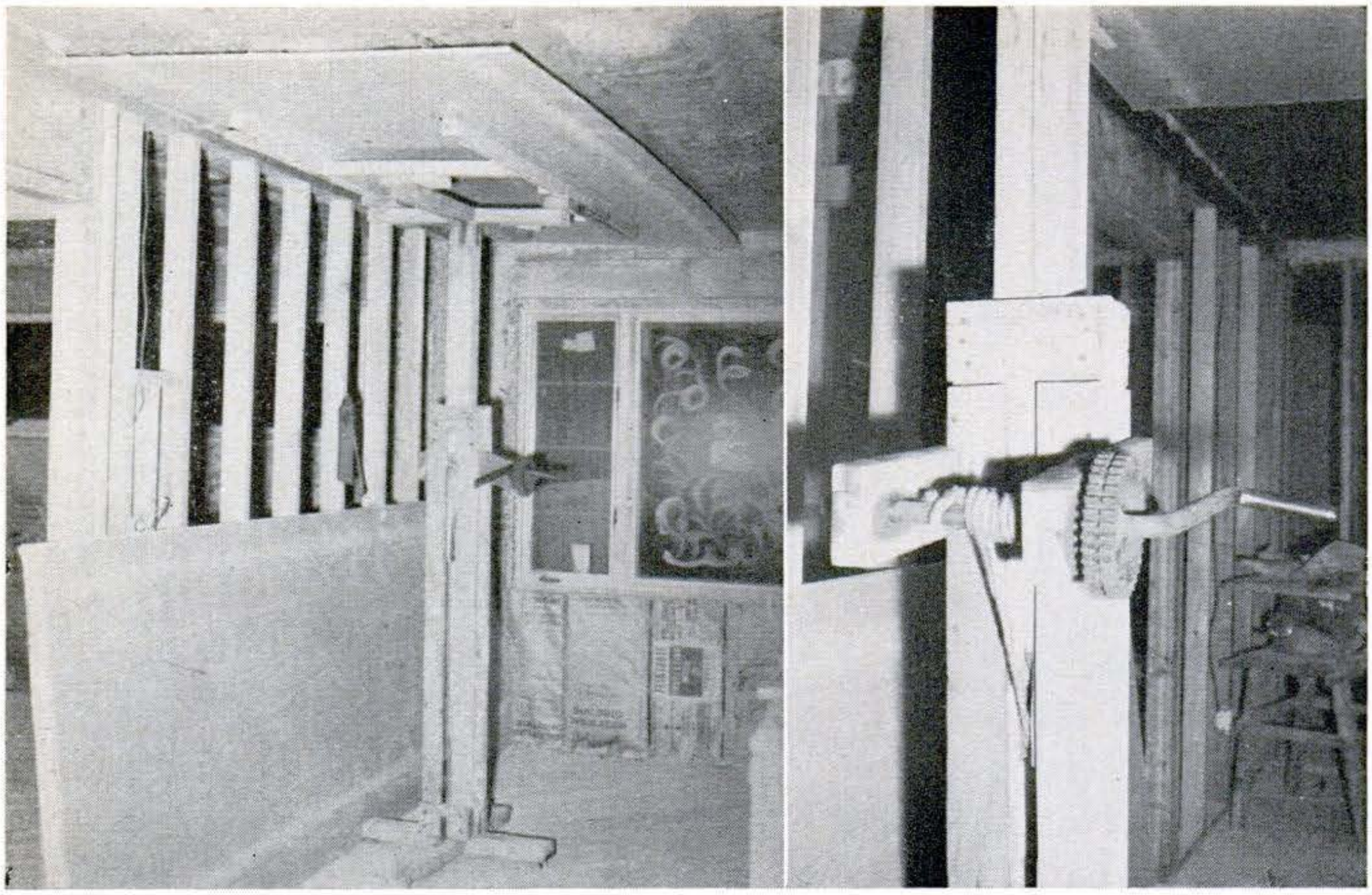


Windlass Hoists Plasterboard to Ceiling for Nailing

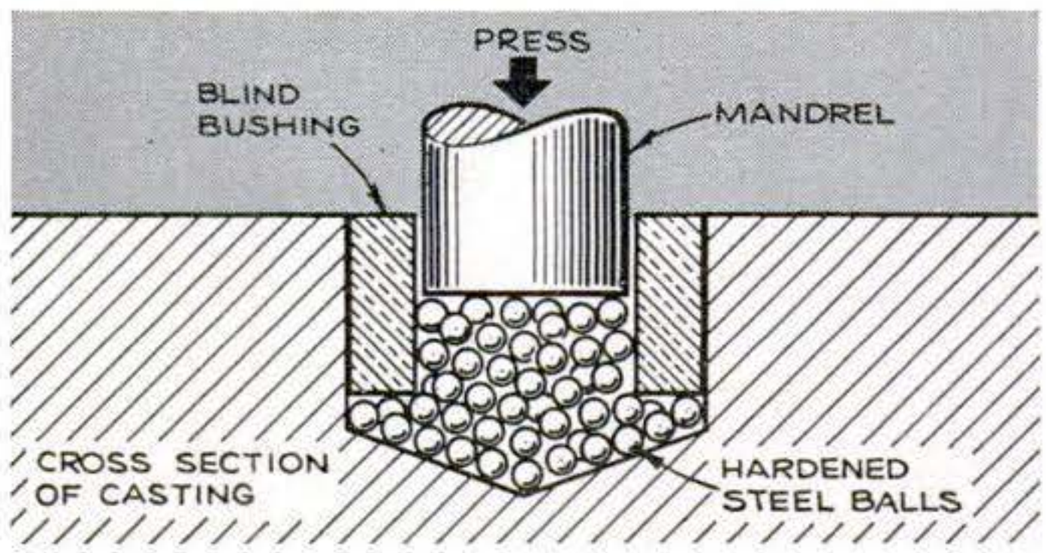
NAILING plasterboard or other construction panels to a ceiling is an easy one-man job with this homemade hoist.

The vertical assembly consists of a pair of two-by-fours nailed together and sliding in a box channel. A rope permanently anchored to the channel passes through a pulley in the base of the movable upright to a windlass located on the opposite side.

After the plasterboard has been placed on the horizontal platform, winding up the rope hoists the board to the ceiling. A piece of strap iron acts as a ratchet to hold it up. Casters on the base allow the panel to be rolled to any desired point before nailing.—*E. V. Reyner, Townsend, Mont.*

Label Saves Record-Handling

GLUE a white label on each of your phonograph records and mark on it the name of the tune on the opposite side. If this side is then kept facing up, you won't have to turn each record over as you look through them for a favorite melody. —*Gilbert C. Close, Hawthorne, Calif.*



How to Remove Blind Bushings

THE usual method of removing a blind bushing is to fill the hole with heavy oil and press in a mandrel to force out the bushing. This may not work, however, if the bushing has been worn out of round so that the plunger isn't a snug fit.

In such cases, fill the cavity with small steel balls and use a press to force a mandrel against them. The hardened balls will exert upward pressure on the bushing.—*Hugh Lineback, Stillwater, Okla.*

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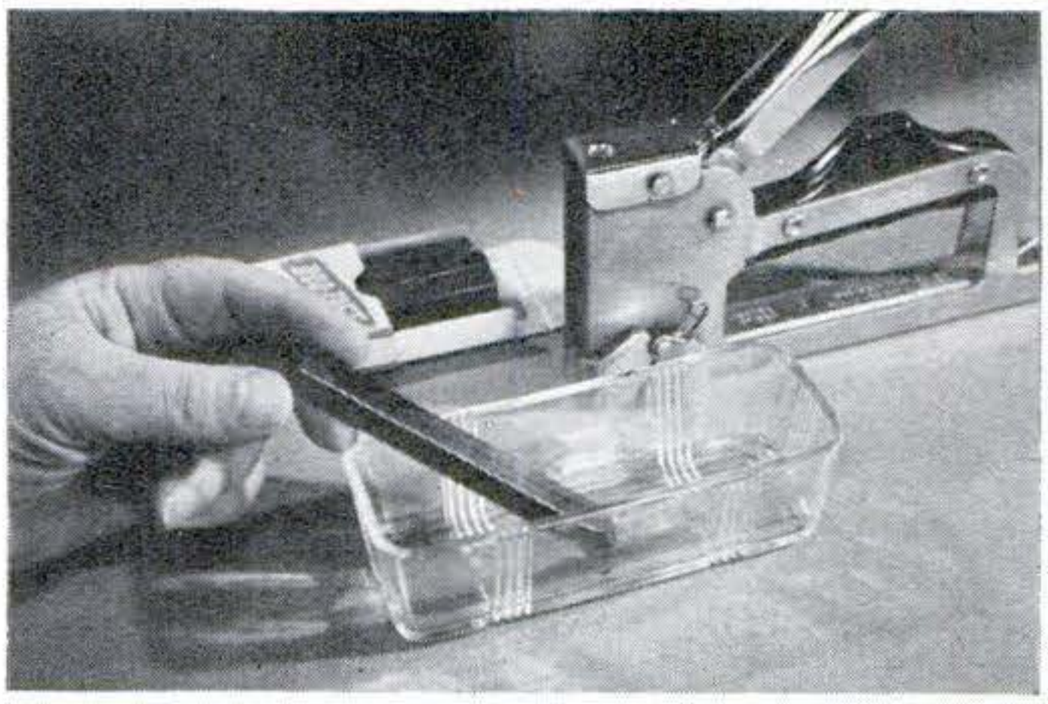
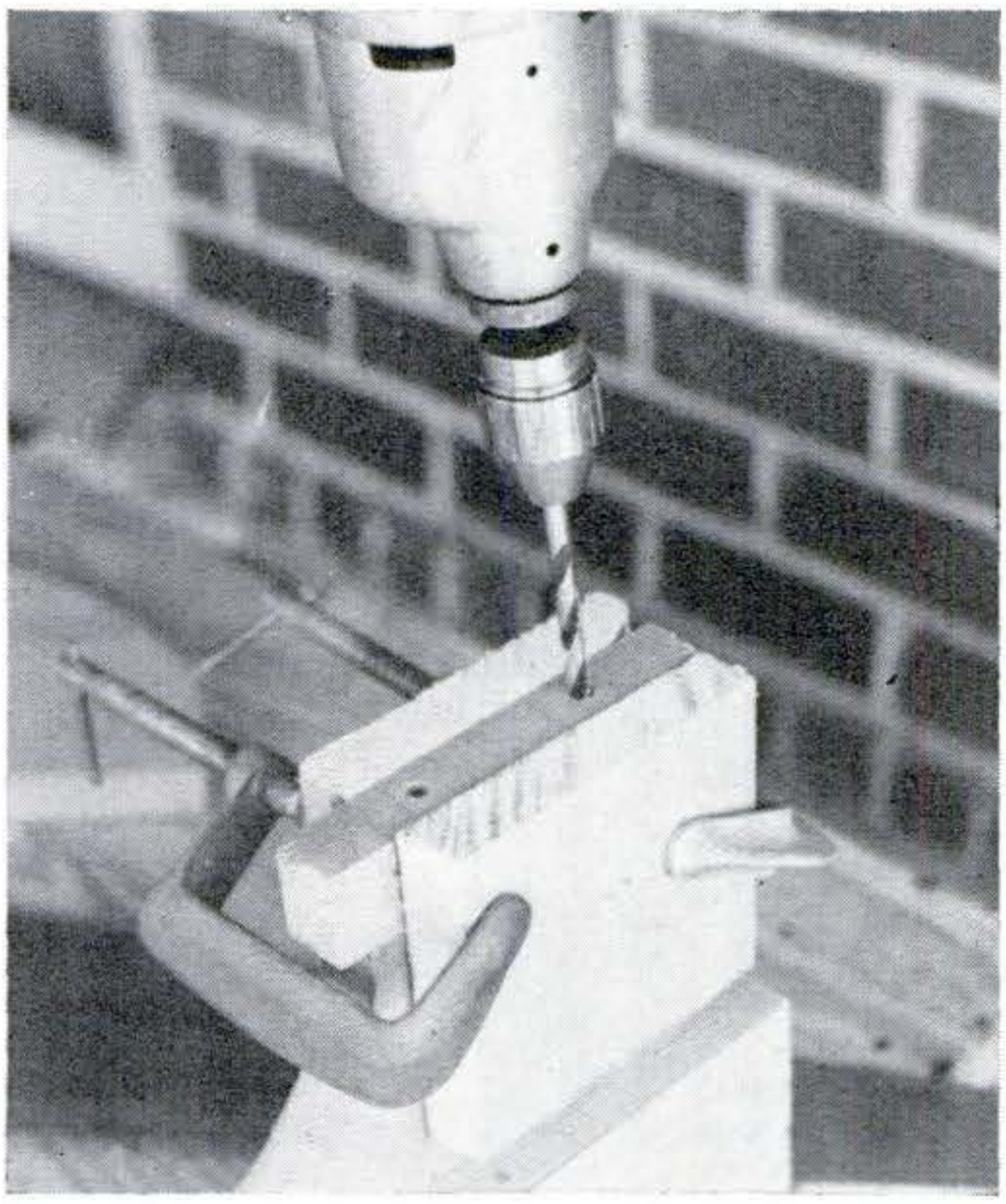


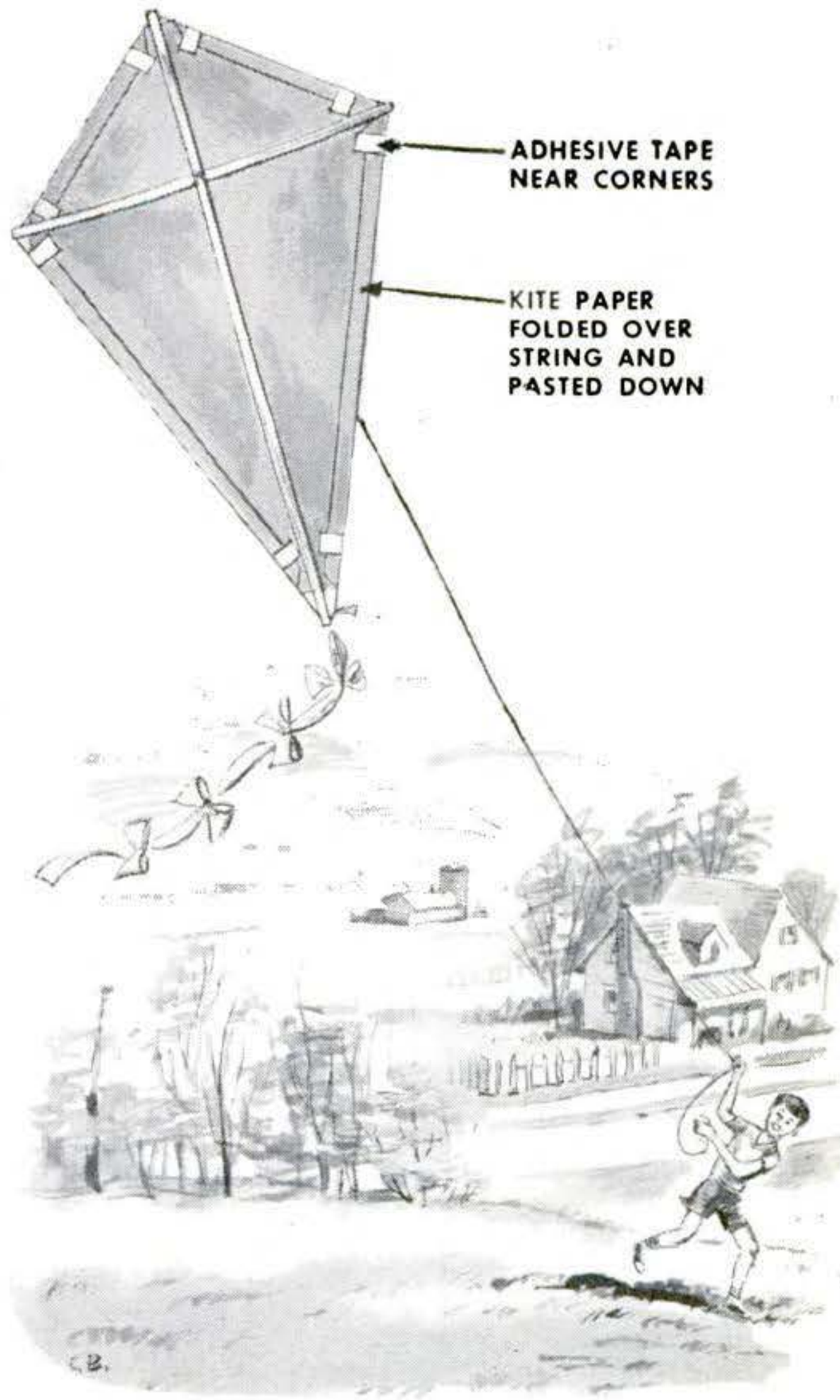
Gum Gives Staples Firm Grip

IF YOU gum staples before using them in wood, they hold better. A good coating consists of a teaspoonful of powdered rosin and 10 drops of varnish, dissolved in 1 oz. of turpentine. Put the solution in a narrow container like the butter-dish cover above, immerse staple points and let dry on newspaper. The coating also gives nails a firmer grip.



Jig Lines Up Dowel Holes

ALIGNING holes for dowel joints is easy if you use this method. Lay a jig block of the same stock on one of the edges to be drilled and clamp it in position. Drill perpendicular holes through the centerline of the jig into the stock. Remove the jig and, turning it over, clamp it in a corresponding position on the other part. The holes in the jig will guide the drill into the facing edge, producing holes that mate with those in the first piece.—*Maj. R. H. Clagett Jr., Columbus, Ga.*



Reinforced Kite Flies Longer

YOU can add to the life of your youngster's kite if you reinforce the corners over the peripheral string with bits of tape. This adds strength at points most likely to tear. —*R. M. Woodbury, Natick, Mass.*

Tape Protects Binder Holes

BETTER than the application of individual gummed rings is the reinforcement of binder pages with cellulose tape. Press half the width on one side of the holes and fold over.—*Ken Murray, Colon, Mich.*

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How to Mix and Use Liquid Fertilizers

By J. B. Mullen

IF YOU want to grow big plants fast, you can't beat the new soluble fertilizers. Because they are liquid, they get to the plant in less time and produce results more quickly. You can sprinkle them right onto the leaves—dry fertilizer would "burn" if applied that way—for fastest action, or you can pour them on the ground around the plant. They work fine on everything from African violet house plants to lawns and shade trees.

Besides making your garden grow faster, liquid fertilizers are a lot more convenient to use. You can save work by combining fertilizing with other spraying or sprinkling chores. Lawns and many flowers can get their feedings as part of a regular watering.

If you spray fruit trees with DDT, you can mix fertilizer into the insecticide solution and feed the tree while you kill the bugs.

Several brands of ready-to-dissolve fertilizers are on the market, but you can reduce the cost by mixing your own. You need three chemicals: potassium nitrate (saltpeter), monoammonium phosphate and urea. All three of these chemicals supply nitrogen, while the ammonium phosphate also supplies phosphorus and the potassium nitrate gives potassium.

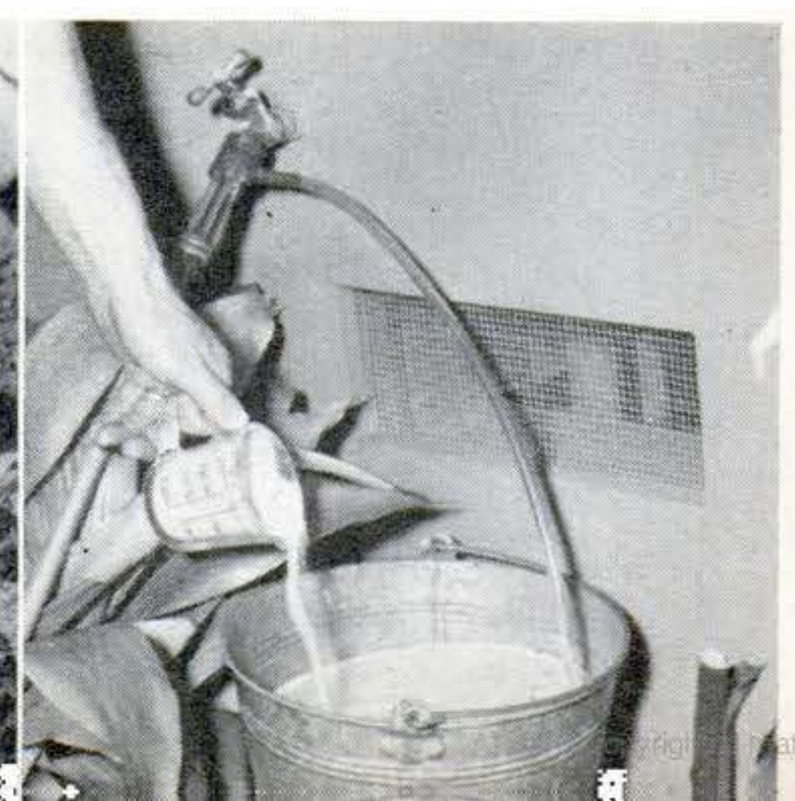
You can buy these chemicals from laboratory- or chemical-supply houses in most cities. Ask for "technical" or "fertilizer" grades, which are cheaper.

How to mix. Different plants require different proportions of the three plant-food elements—leafy plants need lots of nitrogen, root crops don't. Formulas for three common mixtures are given in an accompanying table (the numbers indicate the percentages of nitrogen, phosphoric oxide and potassium oxide, respectively). Other ratios are easily obtained. Equal volumes will give a 21-21-18 fertilizer, while equal weights make a 23-20-15 fertilizer. If you have no scale for weighing, measure by volume (see table).

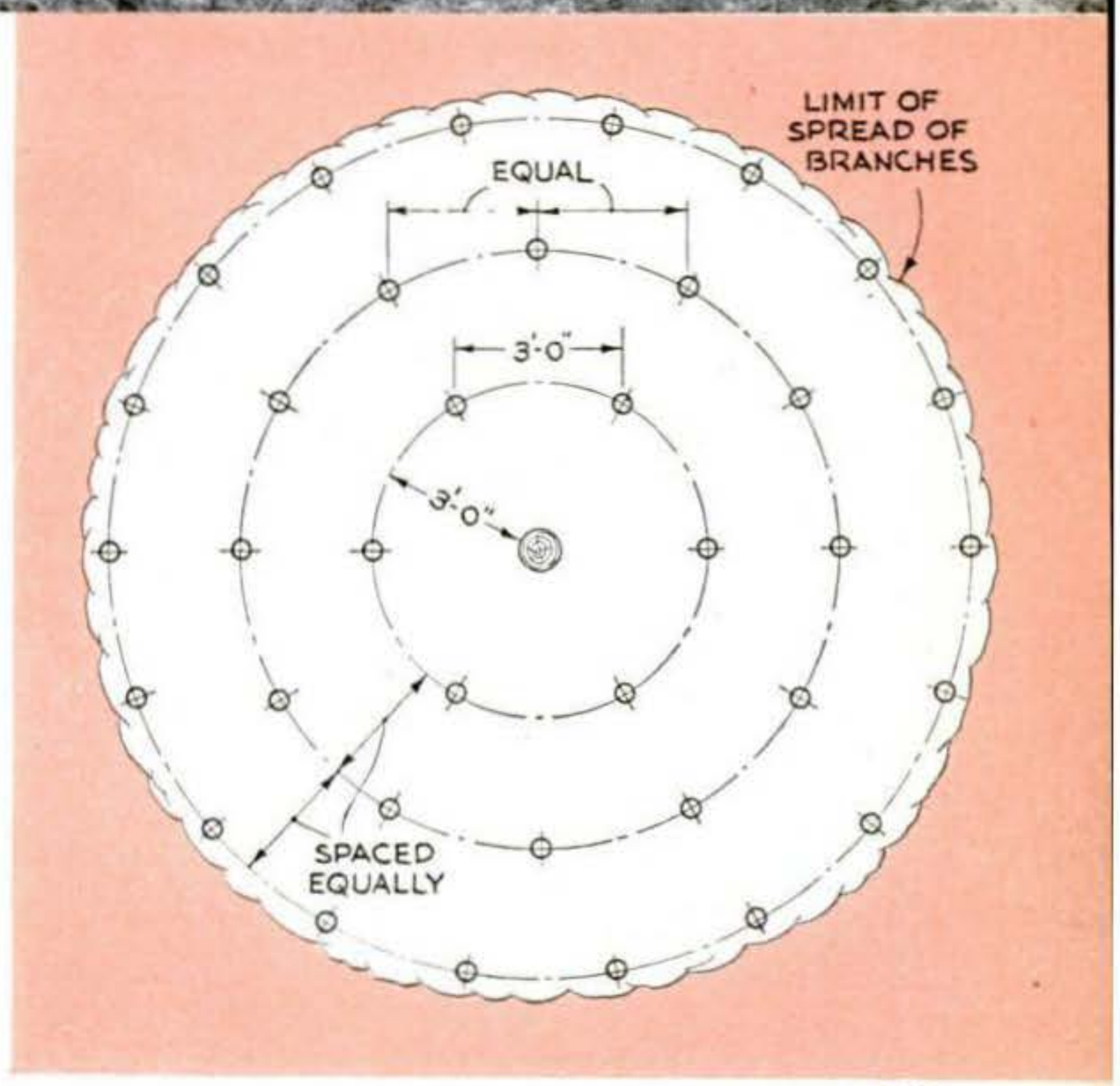
The actual mixing is best done by dumping the dry chemicals onto newspaper and turning the stuff over and over with your hands. It must be completely and evenly mixed because you will later want to scoop out a spoonful or cupful of properly proportioned fertilizer. Another way is to dissolve the dry chemicals—unmixed—into a concentrated solution.

How to apply. You have to dissolve the dry mix in water before using. It is

SPRINKLE, POUR OR SPRAY IT—you can choose among three ways of applying liquid fertilizer. When it is sprinkled, leaves absorb some. Pour solution (center) into the ground when transplanting. The hose attachment (right) feeds a lawn while it is being watered.



TO FEED A TREE, punch holes in the ground in the pattern shown at right, pour in liquid fertilizer and then fill the holes with soil.



concentrated and will burn your plants if applied dry.

The standard-strength solution takes ⅛ pound (¼ cup) of mixed fertilizer to a 12-quart pail of water. For larger or smaller amounts of the standard-strength solution, use these proportions: one teaspoon to one quart of water; one heaping tablespoon to a gallon; ¼ pound (½ cup) to six gallons; one pound (two cups) to 25 gallons.

For garden plants—flowers, vegetables and shrubs—sprinkle the standard-strength solution directly onto the leaves from a watering can, applying it

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about every two weeks. Large garden areas can be treated with one pound of the fertilizer (25 gallons of solution) per 1,000 square feet. On potted plants and window boxes, substitute the fertilizer solution for the regular watering once every two weeks.

Some house plants, such as African violets and gloxinias, are too delicate for leaf-feeding. Instead, apply a half-strength solution to the soil around the plant every two weeks in place of the regular watering.

For transplanting, use a double-strength solution, but do not apply it directly to the plants. Use it to saturate the soil around the roots. Follow with supplemental leaf-feedings of standard-strength solution every two weeks or so if shrubs look sickly after they have been transplanted.

Trees can be fed with standard-strength solution shortly after they have leafed out. Pour the solution—a gallon or more, depending on the size of the tree—into holes poked in the ground. The holes should be an inch or two in diameter, about 12 inches deep, and spaced two or three feet apart from the trunk to the outermost spread of the branches. After the fertilizer has soaked in, fill the holes back up with earth.

Lawns are almost shamefully easy to feed with liquid fertilizer—attachments for your garden hose let you fertilize and water at the same time. One type of attachment is an "aspirator," a long tube that sucks fertilizer solution from a pail and mixes it with the sprinkling water. Another type works much the same way but takes the fertilizer solution from a small jar connected to a nozzle that you fit to the end of your hose.

Since the fertilizer is greatly diluted when mixed with sprinkling water, you can use an extra-strong solution: one pound of dry mixture to 10 or 12 quarts of water. This is too concentrated to be applied directly to the lawn and should be used only with a hose attachment.

Use about one pound of fertilizer for each 2,000 square feet of lawn, applying it every two or three weeks. New lawns will require more feeding—say once a week—to get started. In hot, dry weather fertilize less often. END

Three Formulas for Mixing Soluble Plant Foods

	1-LB. BATCH	10-LB. BATCH
Balanced fertilizer (Approx. analysis, 20-20-20)		
Potassium nitrate	7 oz. (¾ cup)	4¼ lb. (7½ cups)
Urea	4 oz. (⅔ cup)	2½ lb. (7 cups)
Monoammonium phosphate	5 oz. (⅔ cup)	3¼ lb. (6½ cups)
High-nitrogen fertilizer (Approx. analysis, 24-17-16)		
Potassium nitrate	5½ oz. (⅝ cup)	3½ lb. (6⅛ cups)
Urea	6 oz. (1 cup)	3¾ lb. (10¼ cups)
Monoammonium phosphate	4½ oz. (⅝ cup)	2¾ lb. (5½ cups)
High-phosphorus fertilizer (Approx. analysis, 19-23-17)		
Potassium nitrate	6 oz. (⅔ cup)	3¾ lb. (6½ cups)
Urea	4 oz. (⅔ cup)	2½ lb. (7 cups)
Monoammonium phosphate	6 oz. (¾ cup)	3¾ lb. (7½ cups)

NOTE: The analysis figures indicate approximate percentages of nitrogen, phosphorus and potassium, respectively, in the fertilizer mix. To mix, use the equivalent volume of each ingredient if you don't have a scale.

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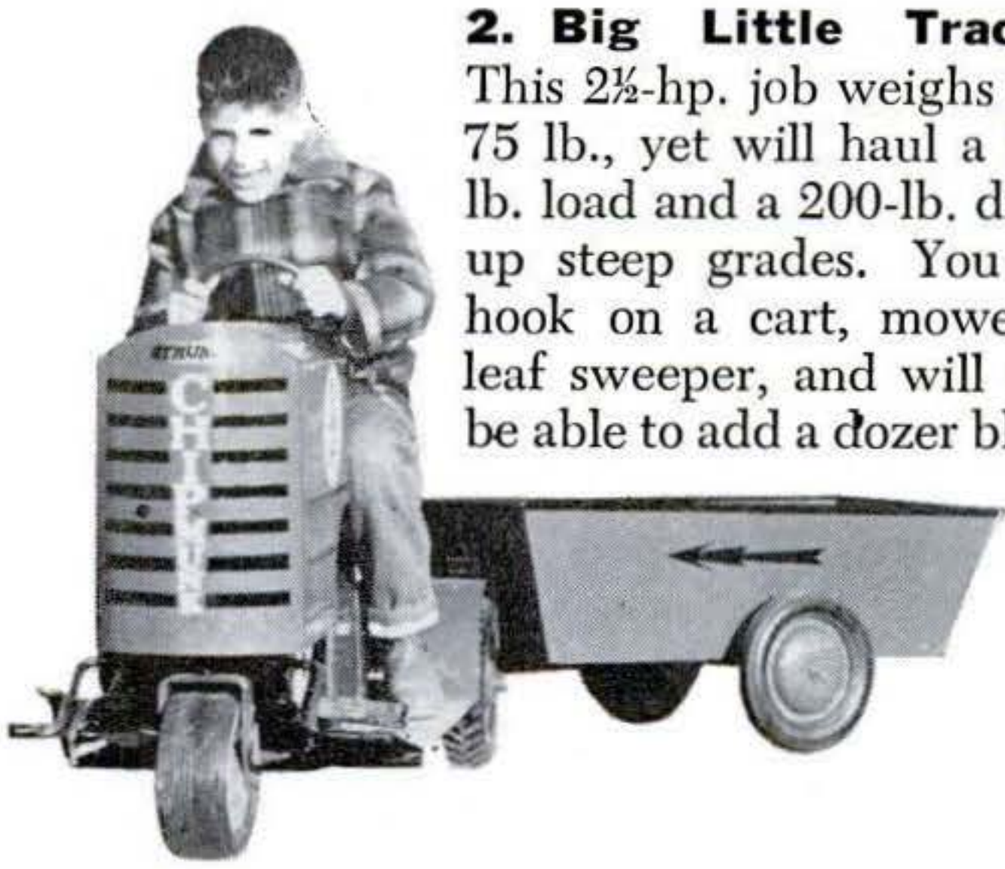
New for Your Yard

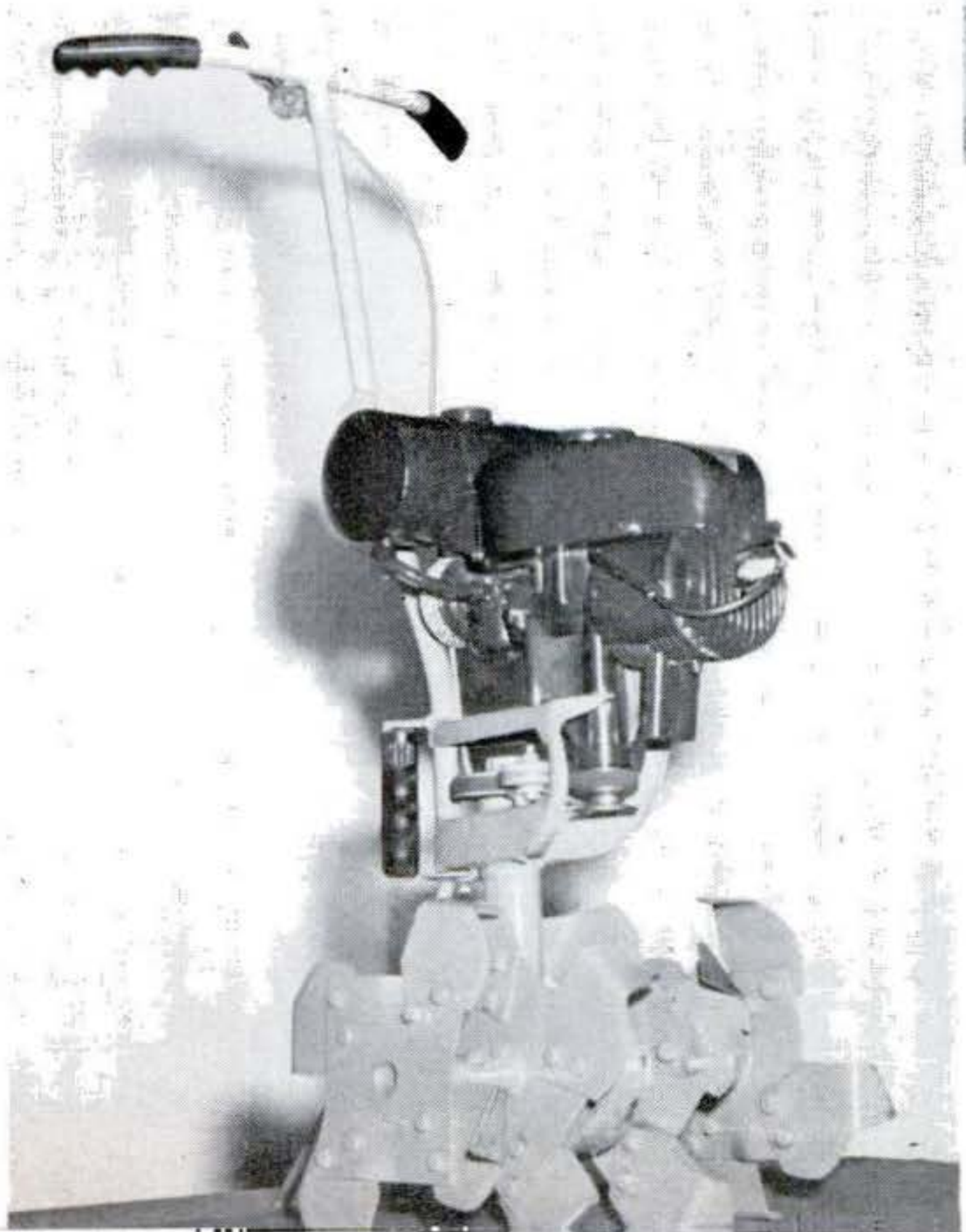
1. Combination Mower Cuts Anything. This unusual mower is said to have the advantages of both reel and rotary types. Many small, high-speed blades rotate on a reel-type shaft. These slice through tall, tough grass, yet cut evenly. Revolving away from the operator, the blades can't fling back debris.

Further information about the garden tools described on this page can be obtained from: 1. Henderson Mfg. Co., Fisher, Ill.; 2. Strunk Equipment Co., Stroudsburg Rd. and Ercildoun Pk., Coatesville, Pa.; 3. W. R. Brown Corp., 2701 N. Normandy Ave., Chicago; 4. Univator, Inc., 2035 Center St., Berkeley, Calif.



2. Big Little Tractor. This 2½-hp. job weighs only 75 lb., yet will haul a 500-lb. load and a 200-lb. driver up steep grades. You can hook on a cart, mower or leaf sweeper, and will soon be able to add a dozer blade.

3. Drill Powers Cultivator. Chucked in any ¼″ electric drill, the long-armed tiller attachment above reaches in and around delicate plants where bigger machines can't go. Small rotating blades churn up soil, chop out weeds and dig narrow furrows to any depth.



4. Portable Tiller Weighs 35 Pounds. You can "walk" this rotary tiller, or collapse the handle and pick it up for use around wall- or box-plantings. Its slow-turning blades will dig up to 8″ deep, and can be adjusted to cut a swath from 12″ to 24″ wide. It comes with either a gasoline (left) or electric motor.

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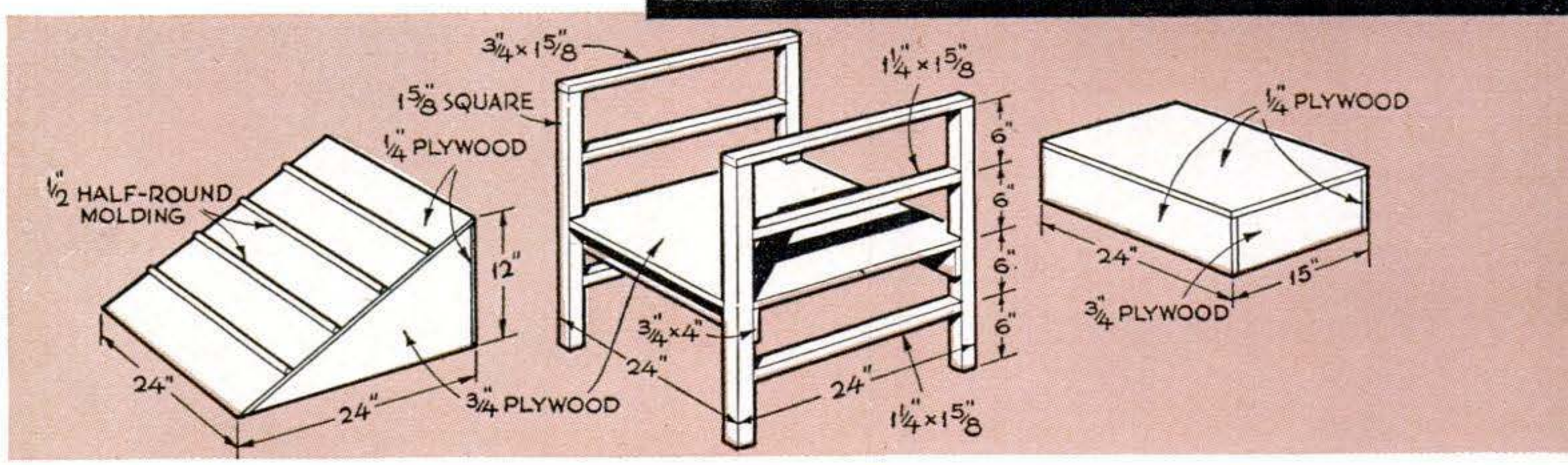
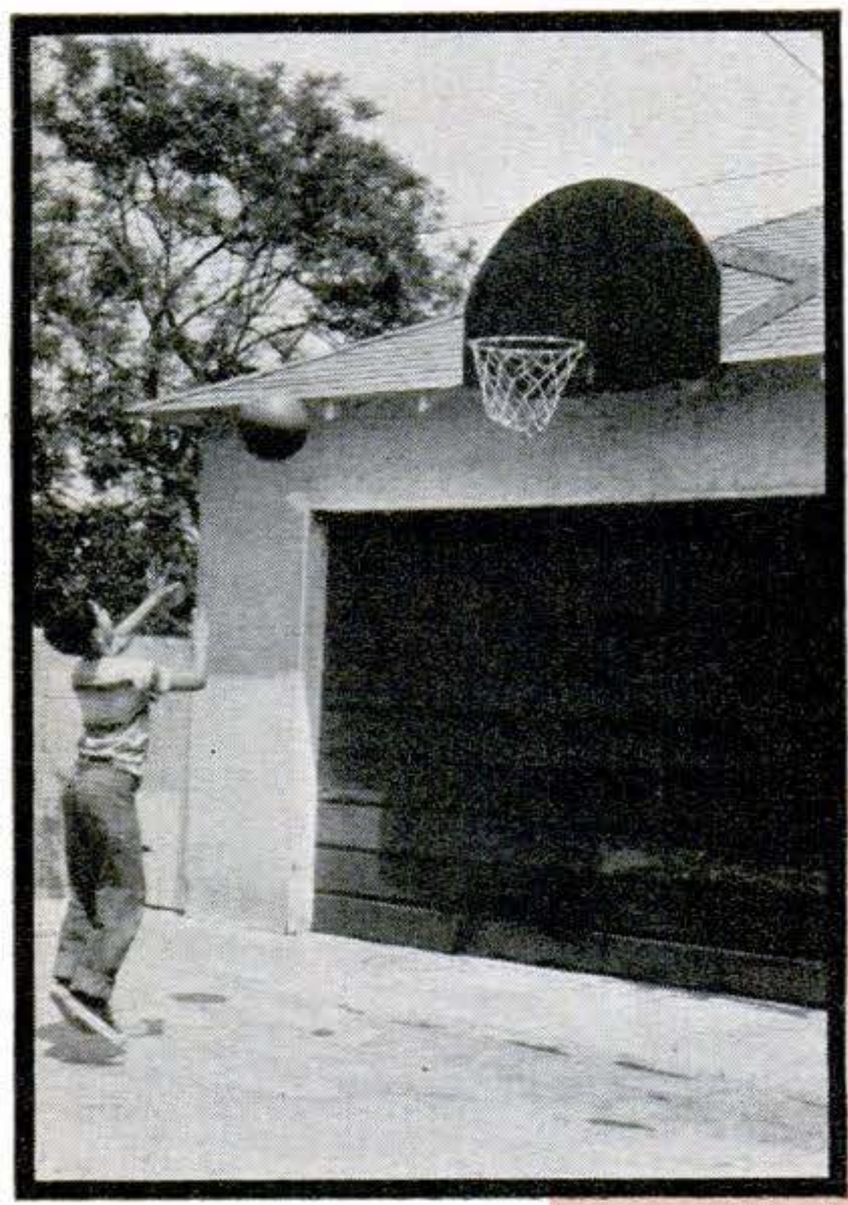
One-Evening Projects

Three Back-Yard Play Projects

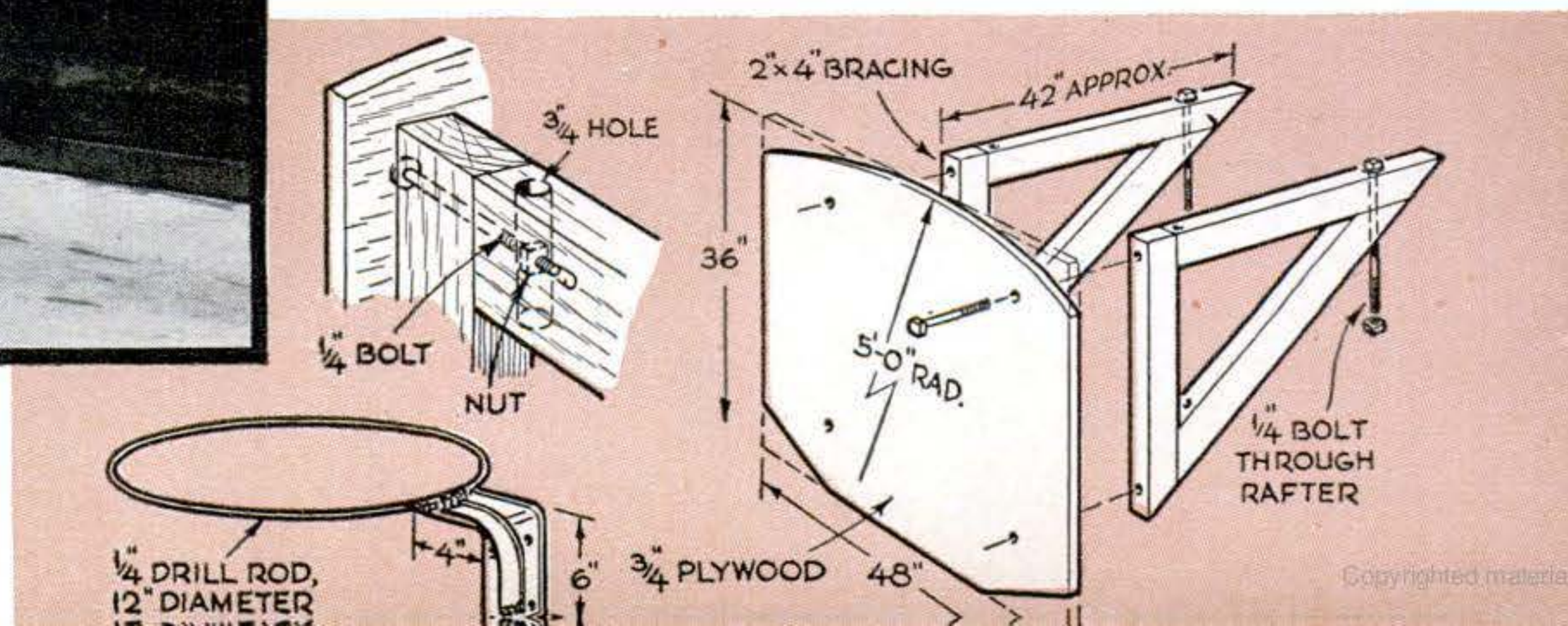
1 Junior gym, for tots from one to three years old, calls for plywood, half-round molding and 1⅝″ pine stock. Its independently constructed ladder, ramp, and step sections can be set up in several different ways, or moved indoors to keep the kids busy on rainy days.

Smooth all parts with sandpaper, rounding the corners and edges slightly. Finish the gym with several coats of high-gloss, light-colored enamel.—*A. Roger Grout, Meadville, Pa.*





2 Basketball backboard that must be mounted on a garage with a sloping roof is easy to build from ¾″ exterior plywood and two-by-fours. The frames that hold the backboard upright are bolted together as shown in the drawing. The bolts at the forward end pass through the backboard, while those at the rear pass through the roofing and rafters. Apply roofing compound to the rear bolts before inserting them in the holes in the roof, and also around the joints afterward. Attach any commercial basket, or make your own by welding a ring of ⅜″ steel rod to a bracket.—*Norman L. Chalfin, Culver City, Calif.*



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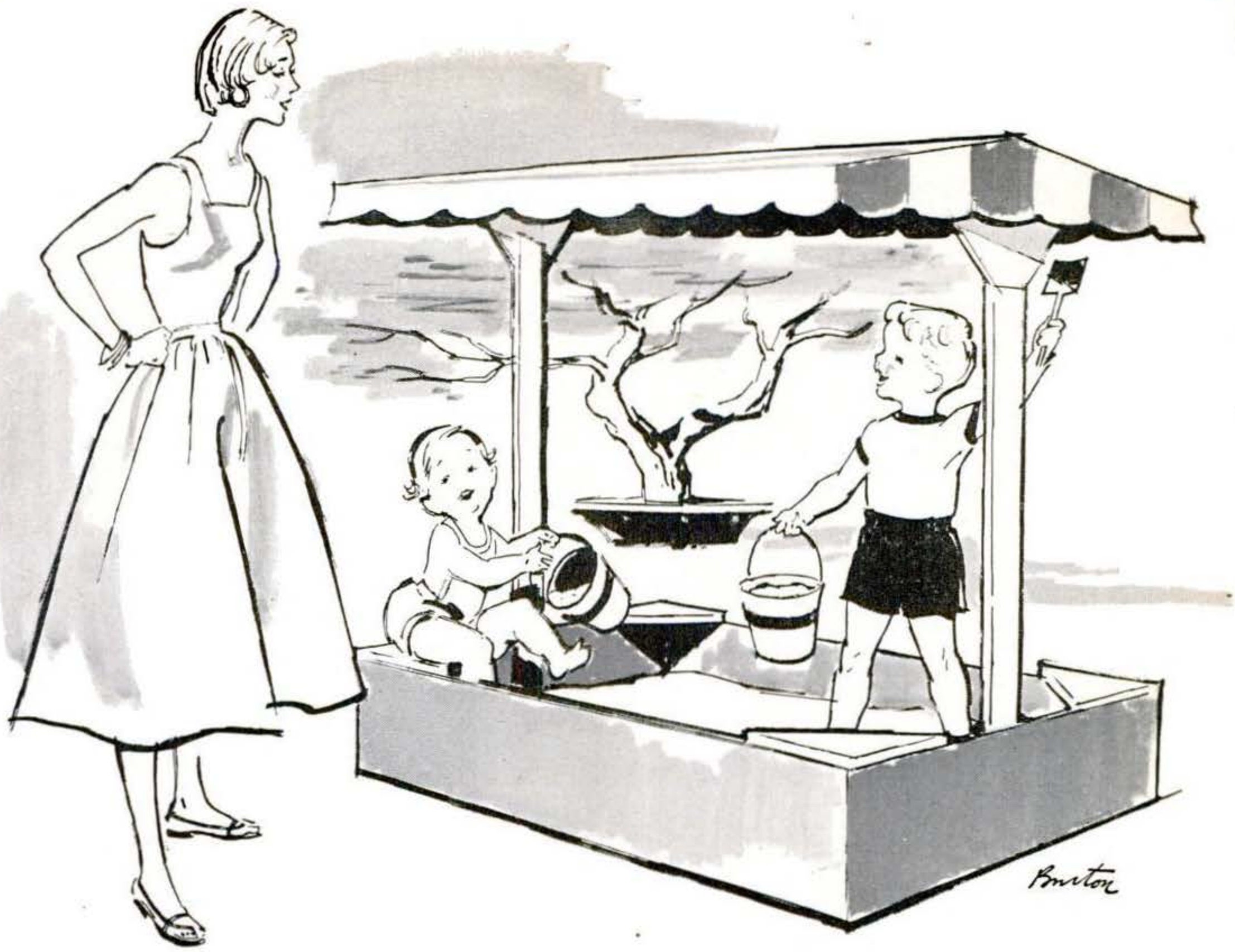

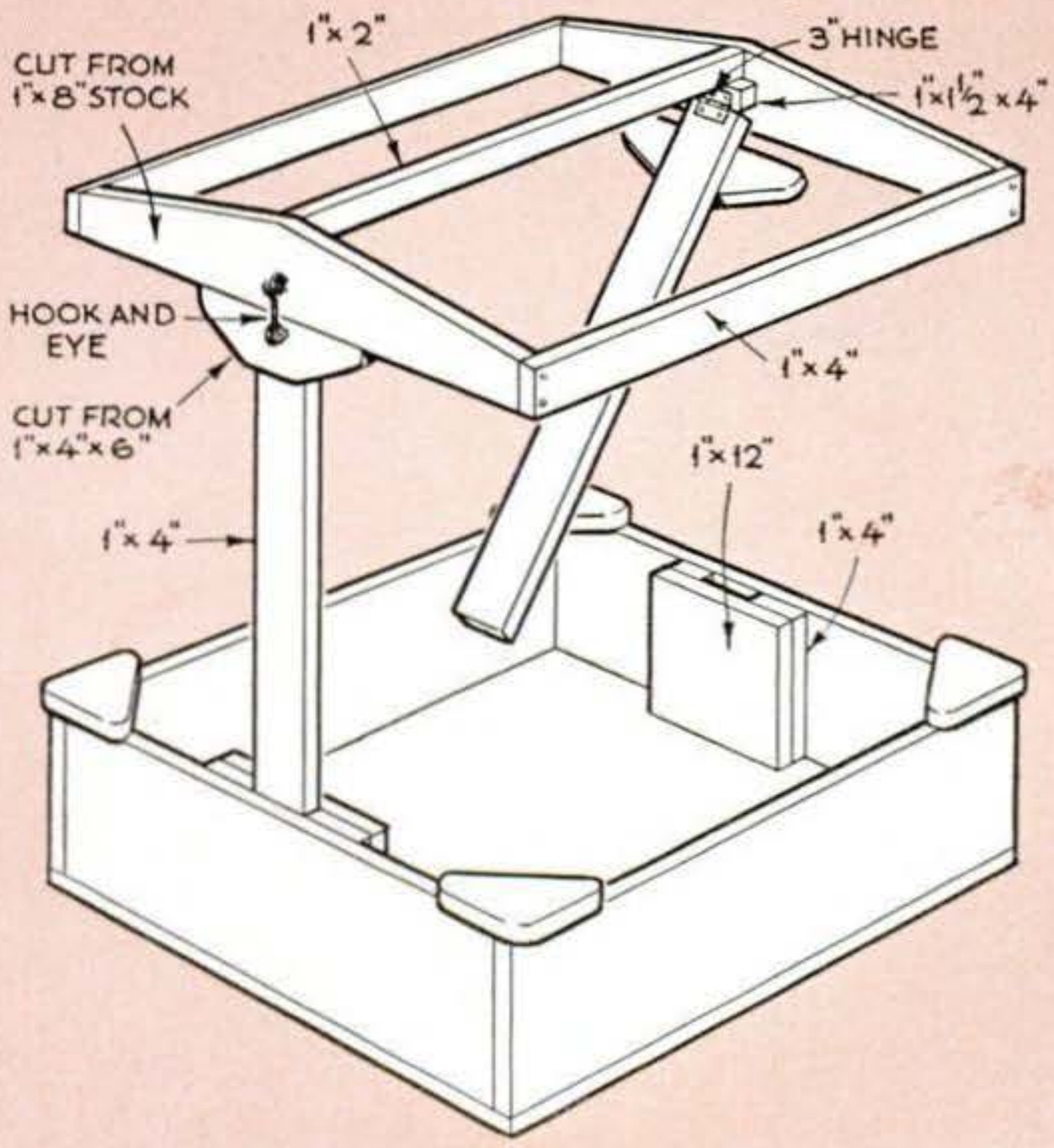

3 This folding sandbox cover serves a double purpose. During play hours it offers comfortable shade; when the box is not in use, you can fold the legs and set the roof directly on the box to keep the sand clean and dry, and to protect grit-covered toys which don't belong indoors.

When the legs are straightened, pockets formed by cleats on the sandbox sides hold them firmly upright. At the same time, the roof is stiffened by butting cross members attached to the legs. Stretch canvas over the frame, tacking it along the ridgepole and all four sides.—*John Voelker, Towson, Md.*

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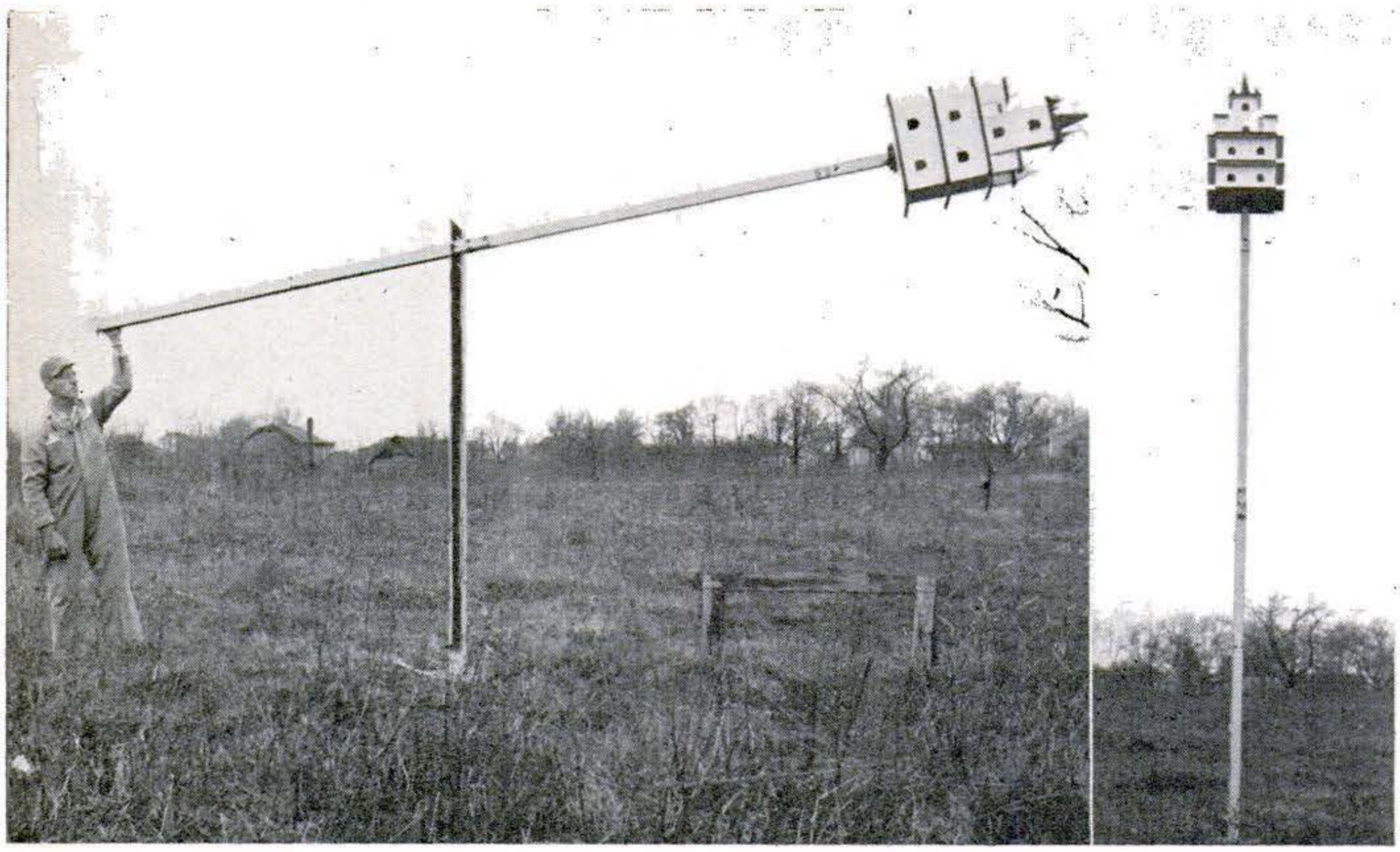
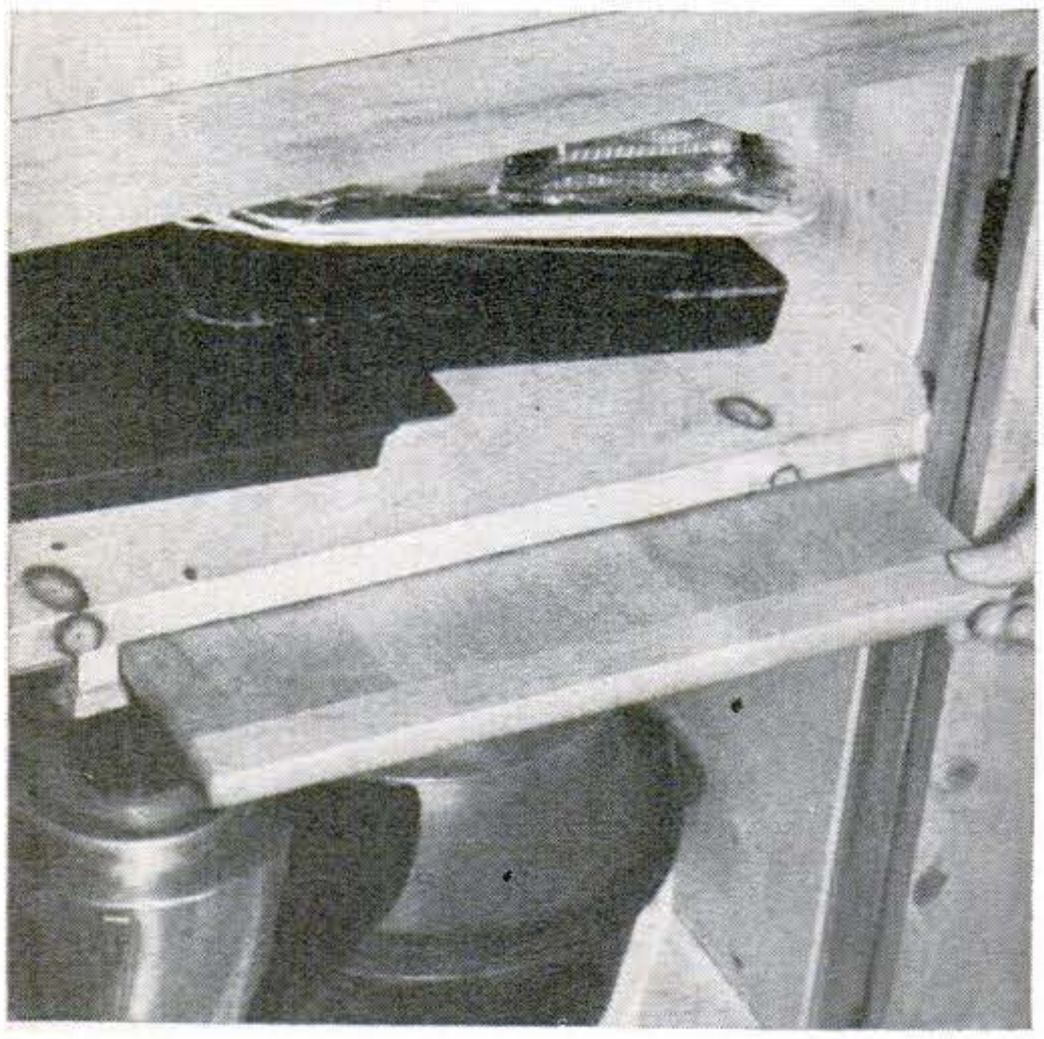


Birdhouse on Hinged Pole Swings Down for Easy Cleaning

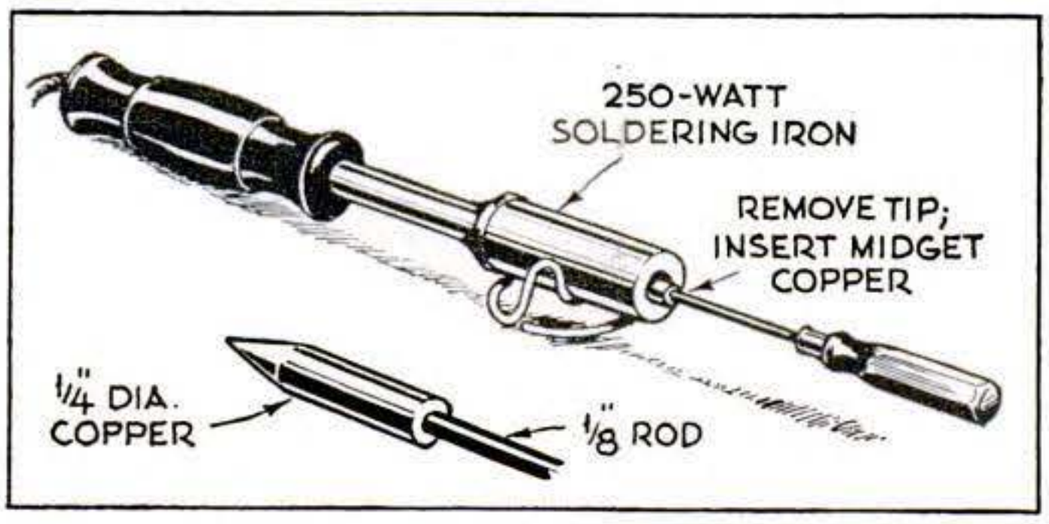
CLEANING a birdhouse often presents difficulties. You can't steady a ladder against the pole, and the house is usually too high to reach from a stepladder.

I solved the problem with an old hinged light pole from a filling station. You can make a similar pole from two lengths of two-by-four. Set the shorter in concrete so it comes about shoulder high, and hinge the other to its top. A hook and eye or barrel bolt near the bottom prevents tipping.—*Carl Miller, Zion, Ill.*



Shelf Cleats Hold Breadboard

L-SHAPED cleats nailed under a cabinet shelf provide convenient storage for a breadboard. A small slot in the underside of the board will make it easy to pull out when needed for use.—*Clinton R. Hull, Santa Ana, Calif.*



Pencil Iron Solders Fine Work

FOR small, delicate jobs you can make a midget soldering iron from a piece of ¼" copper rod filed for a tip and fitted with a handle. Remove the tip from the regular iron, and you have a ready-made furnace. —*Charles H. Willey, Penacook, N. H.*

Turps Restores Sanding Belt

GUMMY deposits loading a disk or belt sander during work on some woods can be dissolved if you squirt the abrasive liberally with turpentine or mineral spirits. Dab off with a rag after a few minutes.—*J. W. McGregor, St. Petersburg, Fla.*

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You Can Have a Gleam Boat

A new trick of molding plastic in cellophane produces a mirror finish you need never replace.

By F. C. Clark Jr.

VISIT the waterways of the Pacific Northwest this summer and you're likely to see boats with a gleaming finish that could serve as a shaving mirror.

Proud owners will tell you that the shining finish is hard as nails and never has to be renewed. They'll show you that harbor scum wipes off readily. Even if a red rowboat rubs against a white finish, scouring powder and a little elbow grease make the white shine like new.

A cellophane mold produces this superfinish. A refinement in applying glass-fiber cloth to boat finishes, the new technique was developed by Stanley A. Hall of Vancouver, B.C., who, like many another boat owner, was an early enthusiast about the permanence of this type of finish.

But he recognized drawbacks. It took long hours of hard work to rub resin four times as thick as paint into the cloth, and it was next to impossible to get a glossy finish. What was needed, Hall reasoned, was an easier method, and a sure way of getting a smooth surface.

He recalled how he used to help Boy Scouts make cellophane molds for model planes. Many experiments later the cellophane boat finish was evolved, with the resin rolled on under the mold. A new business was born.

Finish is permanent. Now you can give a boat a mirrorlike finish free from leaks and annual calking, scraping and painting. Hallcraft Plastics* will do the job for you, or will supply resin, cloth, pigment, cellophane and instructions.

Pigment in the final coat gives you

**2147 E. Hastings St., Vancouver, B.C.*

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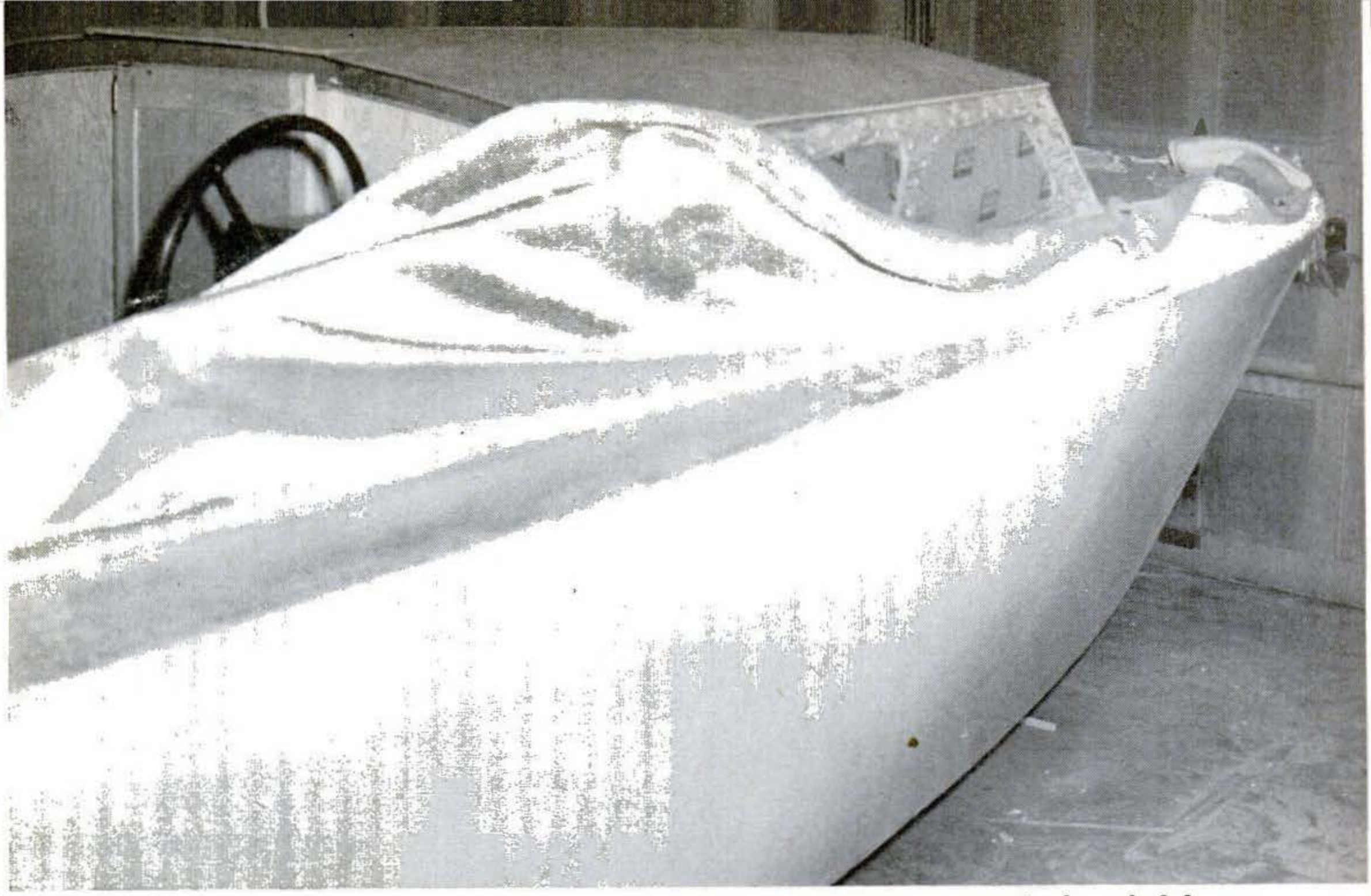


BASE FOR CELLOPHANE FINISH is glass cloth laminated in resin. Here it is laid on the deck and superstructure as well as the hull.

How to get a gleam-boat finish

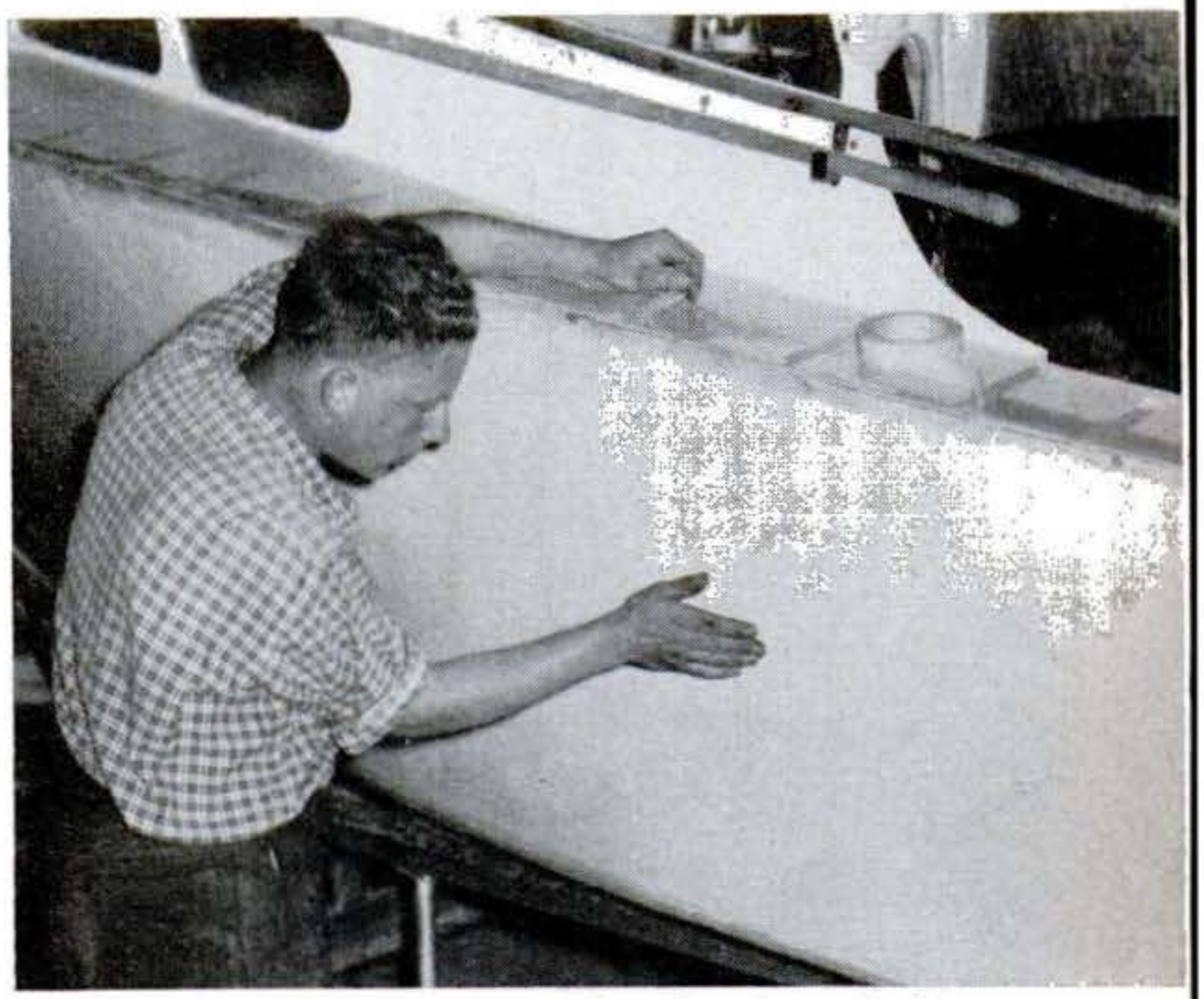
permanent color, and combining glass cloth with resin provides a strength roughly comparable to that of reinforced concrete. It will hold wood fibers in place and prevent the checking caused by continual expansion and contraction of wood that is alternately wet and dry.

Always shiny. The stuff won't chip or crack regardless of the beating a boat takes on or off a trailer or in the water. Marine growth is no problem. Gleaming topsides always look like new paint.

But glass-coating a boat is no snap, even with Hall's new finish. It's a job for the professional lazy man—the fellow who will work like crazy to attain a future relaxing in the sun.

First, with all trim and protruding parts removed and the hull sanded down to the wood, a base coat of resin is rubbed in for thorough penetration into the wood fibers. Next, the cloth is pressed on evenly until every square inch adheres.

Molding the resin. Hall's method takes over at this point. Instead of rubbing six to eight more coats of the honeylike resin into the cloth weave, he stretches cellophane over the hull, tight from stem to stern, taping it firmly at the edges and working out all wrinkles. Even the slightest imperfection will show in the finish.



WRINKLES ARE SMOOTHED by hand and the edges retaped where necessary to work out imperfections that would show up in the finish.

Then he introduces pigmented resin into the cellophane mold through a flat

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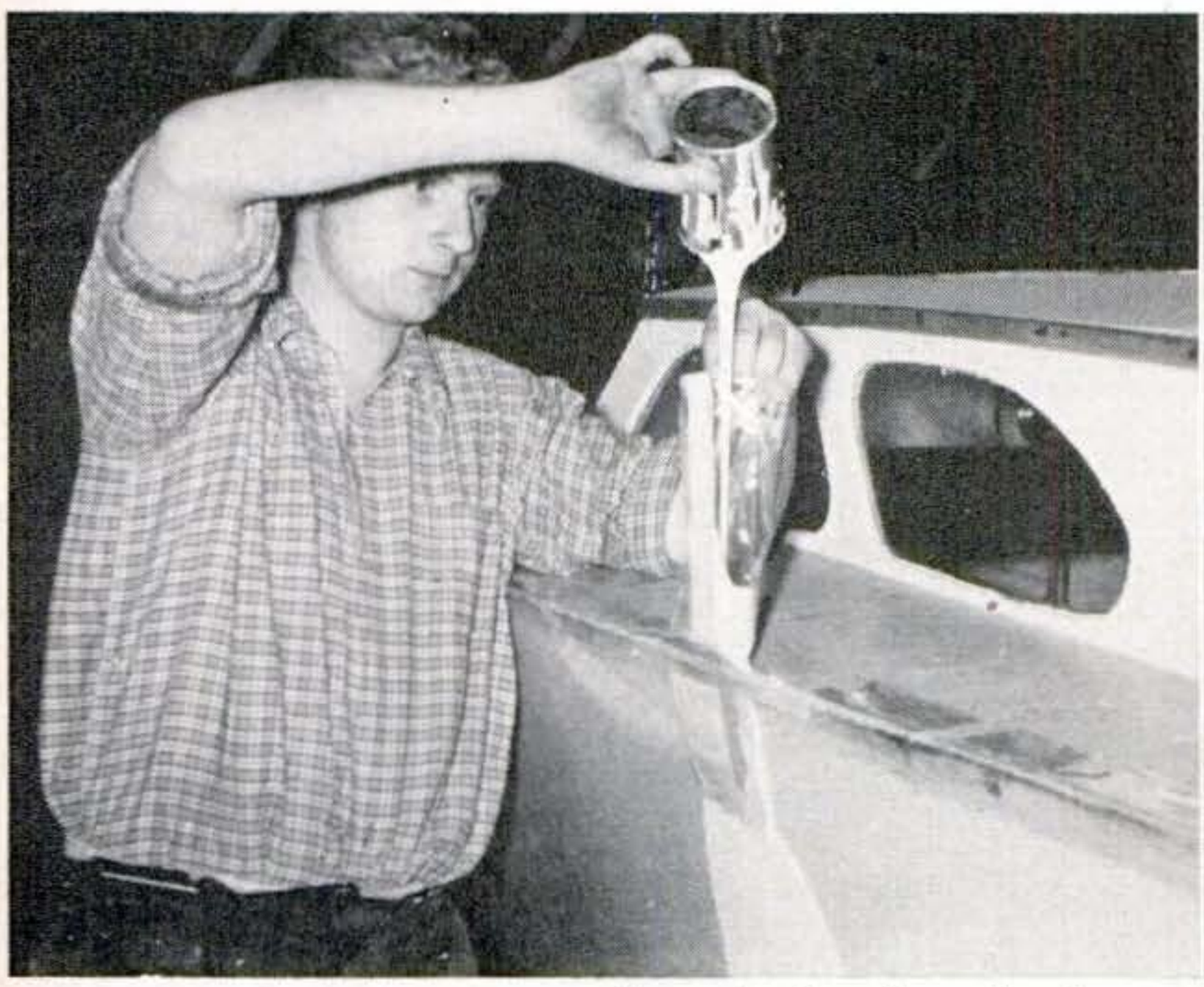
CELLOPHANE IS STRETCHED over hull from stem to stern as a mold for the finish coat. Note masking tape to keep plastic off the transom.

EDGES OF CELLOPHANE are taped down firmly at close intervals to assure a tight mold and even coating of resin over the entire hull.



RESIN IS POURED through flat funnel, about eight ounces at a time. When this has been worked over the hull, more resin is poured in.

HAND ROLLING spreads the thick resin evenly. If two finish coats are applied, permanent pigment is mixed only with the second one.

cellophane funnel. With rubber rollers, he works it over the entire length. When the plastic has set and the cellophane is ripped off, the result is a gleaming glass-smooth surface.

The cellophane technique usually stops with the hull above the waterline. The old method of rubbing is used on the bottom, deck and cabin.

For an ultra-ultra finish—an extra 10 to 15 percent luster—Hall puts on a second coat. In this case, the old cellophane mold is taken off—it won't stand the strain twice—and a new sheet used. END

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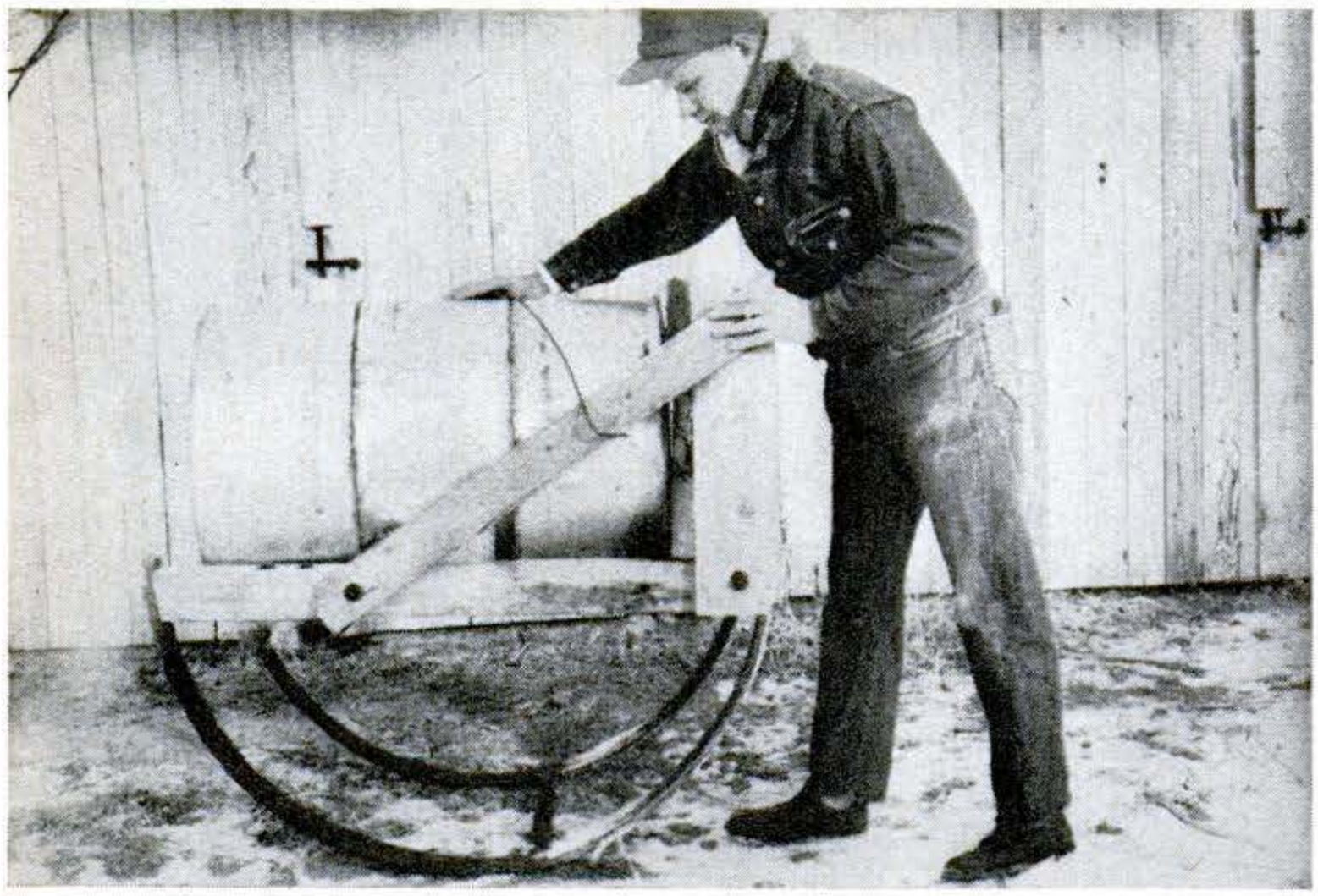
Wagon-Tire Rocking Stand Tilts Barrel for Easy Pouring



ROCKERS on a scrap-lumber frame make it simple to pour from a barrel or oil drum.

A wagon-wheel tire sawed in half provides ready-made rockers. Bolt them to the ends of the frame. Rock the barrel on end for storing, or tilt it to any angle when you need to pour part of its contents. Upper-end stops keep the barrel from sliding off.—*E. V. Reyner, Townsend, Mont.*

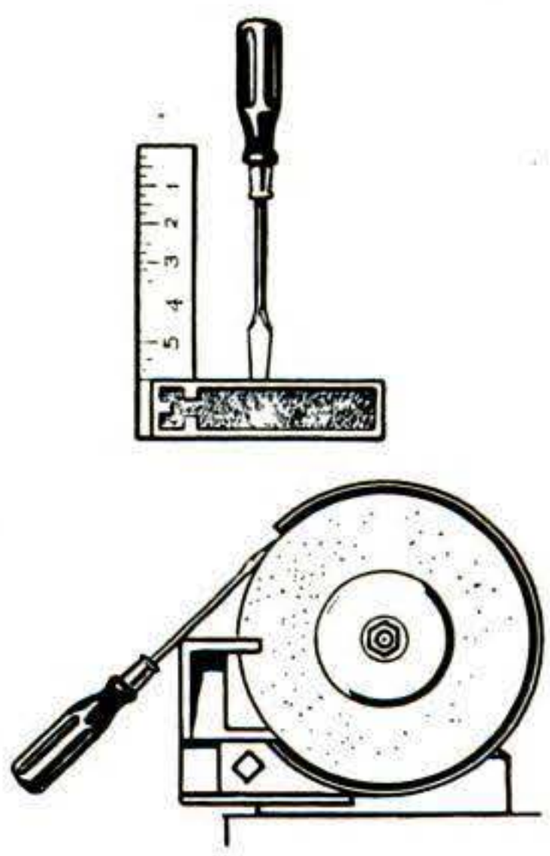
Cellophane Bag Aids Bug Study

CLOSE observation of insects on a nature-study trip is easier if you confine live specimens in cellophane. A clear candy bag or the jacket from a cigarette pack are good cages.—*George Kapitan, Bronx, N.Y.*

Grease Takes Paint Off Hands

WHEN I get paint on my hands, I rub a spoonful of kitchen grease into the pores. Paper towels or rags remove both paint and grease, and soap and warm water finish the job.—*Harvey Wilder, Moorestown, N. J.*

DRESSING A SCREWDRIVER



DRESS the sides of a common screwdriver first so that the blade is symmetrical in shape. Then square off the end, checking squareness by resting the tip on the handle of a try square and moving the shank close to the blade. If the blade and the shank appear to be parallel, the tip is square.

Grind the faces of the screwdriver blade parallel or nearly parallel at the tip. The thickness should be such that the tip will just enter the slot of the screws you intend to drive. With correct thickness and the sides parallel, the screwdriver will have the least tendency to climb out of the slot.

A 6″ wheel produces about the right grind on a screwdriver used for small screws. Hold the blade high on the wheel and rest the shank on the tool rest.

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

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The SPARK for today's high compression and higher horsepower was pioneered by AC

1 An Exclusive Fused Copper-Ceramic Seal —What it *is* and what it does!

Among many important spark plug design features pioneered by AC—the unique Fused Copper-Ceramic Seal stands out as a particularly brilliant technological achievement. The problem was to provide both electrical and thermal conductivity while maintaining the gas-tight seal between the center electrode of the plug and its insulator.

AC engineers came up with a metal-ceramic formula that is the perfect answer. This is a mixture of copper and ceramic material which is fused at high temperatures during plug assembly, and bonds with both the metal of the electrode and the ceramic of the insulator. Naturally, the copper insures high electrical and thermal conductivity.

2 AC Exclusive THIN Insulator Tip Difficult to Form—but worth doing!

If you will examine the firing end of an AC Spark Plug closely, you will observe that, unlike any other spark plug, its insulator tip is made thin by recessing it all around the center electrode wire. At the right is a cut-away to show you how this insulator tip is made.

AC, and only AC, does this—a difficult engineering accomplishment, but worthwhile because it enables the plug to work more efficiently. The thin tip heats faster than a thick tip can—and burns away combustion residues which would otherwise deposit. Briefly—that's why AC Spark Plugs stay clean longer, come to top operating efficiency faster. They boost power and insure quick starting.

AC SPARK PLUGS

GM GENERAL MOTORS

AC SPARK PLUG DIVISION
GENERAL MOTORS CORPORATION
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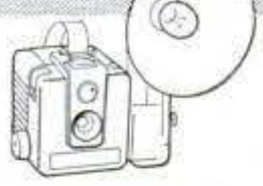
How to choose a camera

The best camera for you is the one that gets the pictures *you* want. So, start off by analyzing your needs. Do you want to take snapshots (black-and-white or color), color slides, or stereo pictures? Are you interested in slow-moving or fast-action subjects? Do you want to be able to take close-ups? Are the pictures for album use or for enlargement? And what about flash shots?

Deciding upon points such as these will help provide the basis for an intelligent, satisfying choice. Then from the comments below, plus the additional details your Kodak dealer will supply, you will be able to select a camera whose type, features, and capabilities are fitted precisely to your needs.

Box and simple Reflex-type Cameras

These cameras are inexpensive, easy to use, need little, if any, adjusting. They have simple lenses, capable of taking sharp, clear snapshots. All shown here take black-and-white or color pictures. They're suitable for snapshots, in good daylight, of non-moving or slow-moving subjects, and for flood and flash shots. The reflex camera is similar to the box type except for a large hooded viewfinder at the top, which shows the subject big and clear just as it looks in the finished snapshot.



MOST POPULAR CAMERA . . .

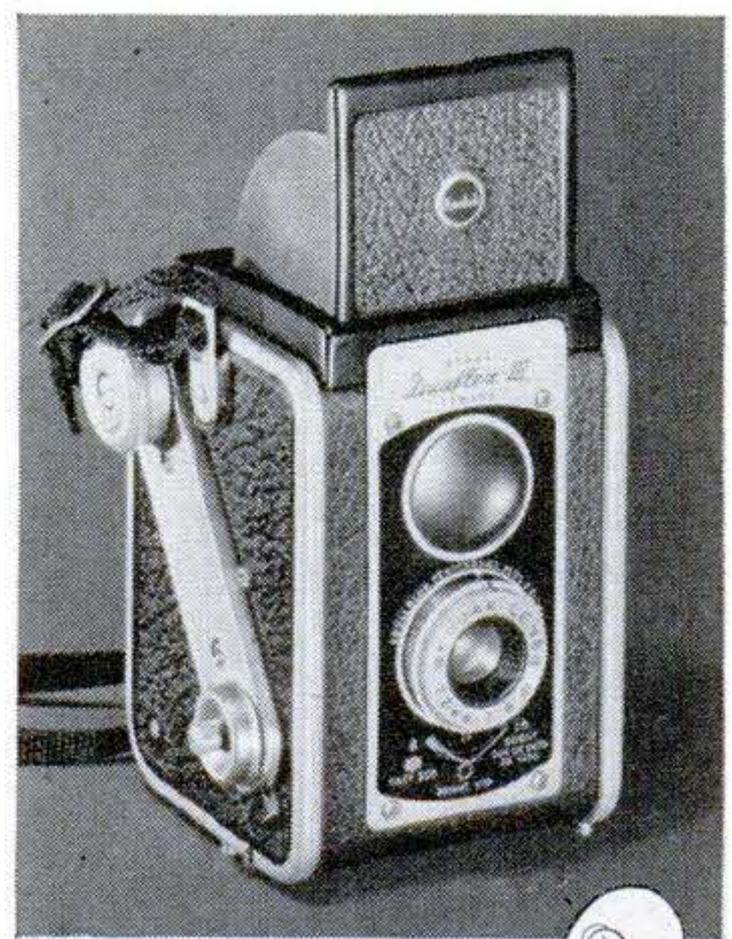
Over 5,000,000 Brownie Hawkeye Cameras now in use. The ultimate in simplicity. Large viewfinder. Fixed-focus lens—no adjustments to make. 12 pictures on #620 films. Standard enlarged prints, 3½" x 3½".

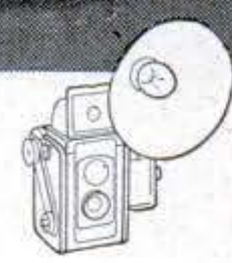
Brownie Hawkeye Camera, $6.95
Flasholder, $4.

UNIQUE DISTANCE-DIAL

on Brownie Bull's-Eye Camera focuses quickly for "Scenes," "Groups," or "Close-ups" down to 4 feet. *Lumenized* lens for sharp detail, color purity. Double-exposure preventer. 8 pictures on #620 films. Standard enlarged prints, 3½" x 5". Flasholder takes new, low-cost M-2 bulbs.

Brownie Bull's-Eye Camera, $12.85
Midget Flasholder, $3.20





ADVANCED SNAPSHOT CAMERA

The Kodak Duaflex III, Kodar model, is reflex-type camera with 3-element, coated lens for sharp detail, color purity. "Faster" *f*/8 lens lets in more light for snaps on dull days. Focuses to 3½ feet for close-ups. Extra-large hooded viewfinder; handy exposure selector; double-exposure prevention. Standard enlarged prints, 3½" x 3½".

Kodak Duaflex III Camera, $22.50
Kodar *f*/8 lens
Flasholder, $4.

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Miniature Cameras

Small and compact, these cameras feature fast lenses (*f*/4.5 and faster), fast shutters, and often other picture-taking refinements such as rangefinder, automatic film stop, exposure counter, etc.

They make crisp color slides (black-and-white or color snapshots, too), using economical 35mm or Bantam-sized films. Their picture-taking scope extends beyond that of snapshot cameras to cover fast-action subjects and subjects under poor lighting conditions. Added controls make picture-taking more precise and thus more satisfying.

Lifelike, 3-dimension color slides are also made with a special type of miniature camera. Known as a stereo camera, it has two lenses spaced about the same distance as your eyes and takes two pictures at the same time. The resulting pictures, when seen in a viewer, appear as a single picture with depth. This added dimension gives them a realistic, true-to-life appearance.

BUDGET-PRICED MINIATURE

The Kodak Pony Camera has Anaston *f*/4.5 *Lumenized* lens, 1/200 shutter, automatic film stop and counter, no-thread loading. Takes 20- or 36-exposure #135 films.

Kodak Pony 135 Camera, $29.75
Model B
Flasholder, $7.95

RANGEFINDER MINIATURE

The Kodak Bantam Camera has an Ektanon *f*/3.9 *Lumenized* lens, super-imposed image rangefinder, automatic film stop, double-exposure prevention. Takes 8 pictures on #828 film.

Kodak Bantam RF Camera, $56.75
Flasholder, $7.95

KODAK'S FINEST LENS

The Kodak Signet Camera features Kodak's famous *f*/3.5 Ektar lens, unsurpassed for quality. 1/300 shutter. Coupled rangefinder combined with viewfinder. Automatic film stop and counter.

Kodak Signet 35 Camera, $75
Flasholder, $7.95

SIMPLIFIED STEREO — Kodak Stereo Camera offers top-quality, precision stereo photography at low cost. New easy distance-selector dials for "Scenes," "Groups," "Close-ups." New easy exposure selector adjusts for "Bright," "Hazy," or "Cloudy Bright" conditions. Matched Anaston *f*/3.5 *Lumenized* lenses, 1/200 shutter. Scopesight viewfinder, automatic film stop and counter, double-exposure prevention.

Kodak Stereo Camera, $84.50
Flasholder, $7.95

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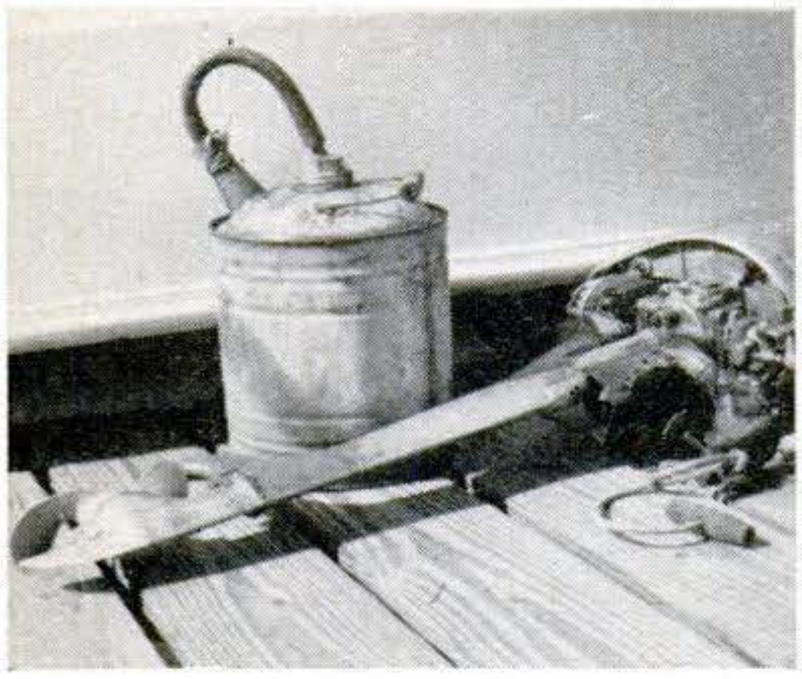
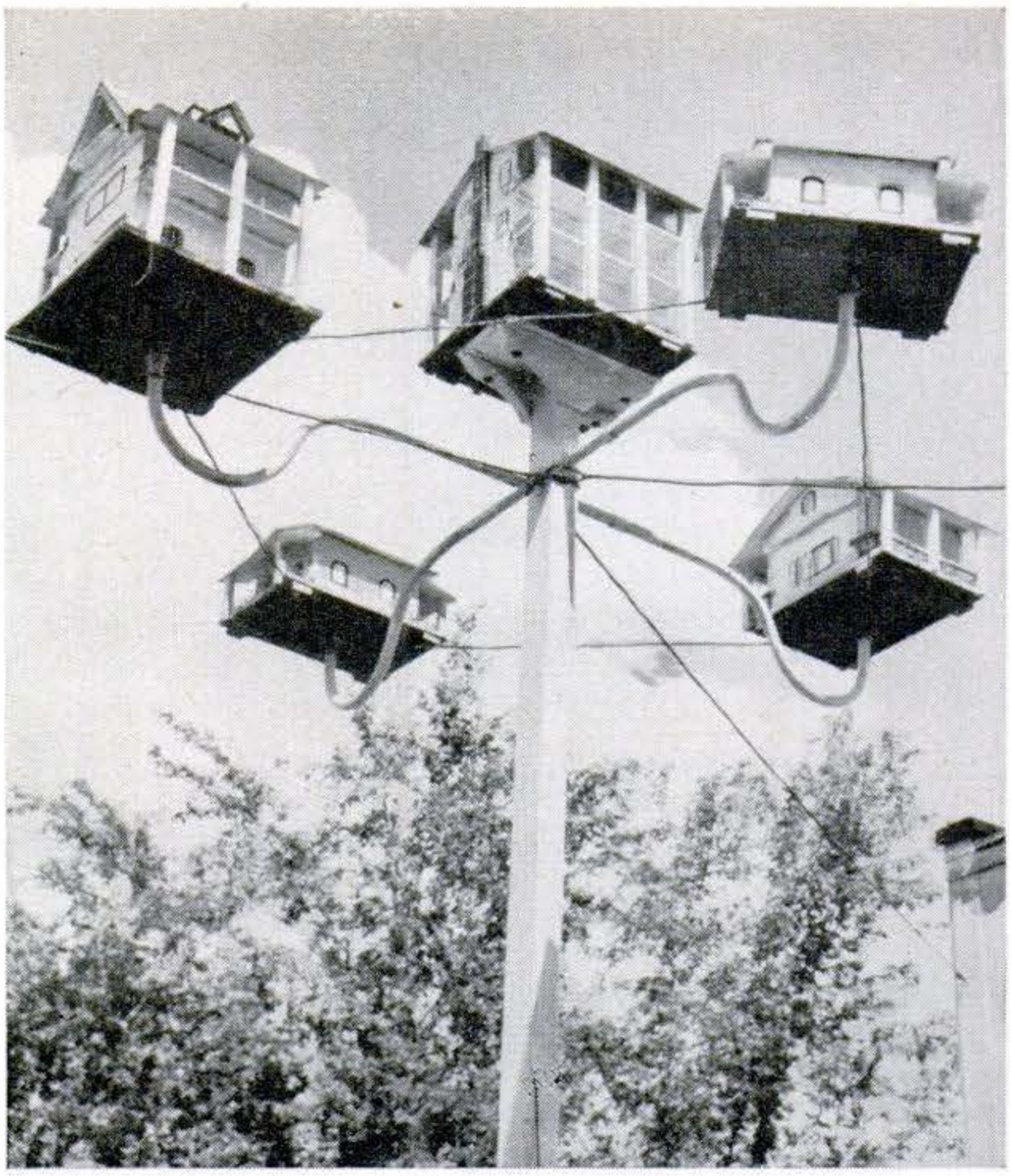


Kerosene Can Makes Spillproof Container

NEOPRENE or plastic hose over the spout of an ordinary kerosene can will convert it into a durable, spillproof fuel container. You will find the galvanized finish more corrosion-resistant than painted steel, even on salt water.

Remove the gaskets from the two caps and punch ⅜″ holes in both caps and gaskets. Insert a flared 2″ length of copper tubing from the inside of each cap, solder strong, leakproof joints, and then replace the gaskets.

Clamp 9″ to 12″ of ⅜″-I.D. oil-resistant hose to the spout. The free end fits over the intake cap for storage.—*Robert D. Simpson, Coconut Grove, Fla.*

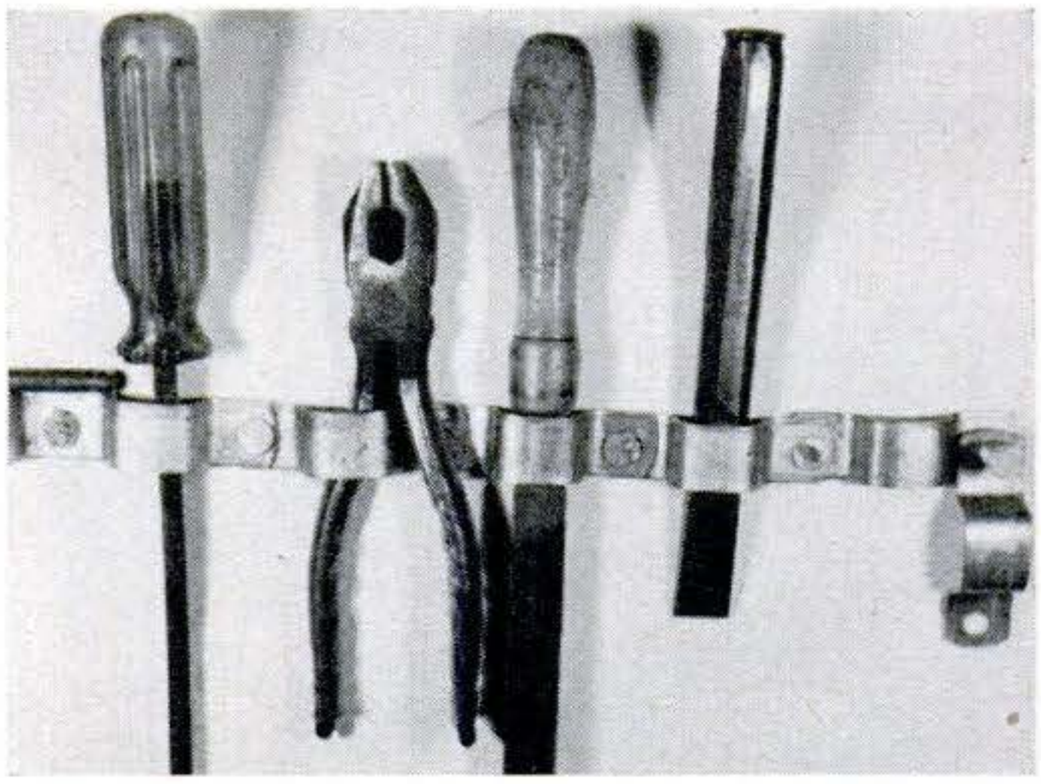


Bird Village Sits on a Single Post

CROSSBARS formed from pipe support four of the houses in this back-yard bird colony. The crossbars pass through holes in the pole. A flange under each house attaches it firmly to the pipe. Guy wires were then added as a precaution against wind. The group housing was erected for a colony of purple martins. —*Grover Brinkman, Okawville, Ill.*

Swivel Stand Holds Parts Jars

SCREW-TOP jars suspended by their caps on a pivoted rack keep small parts handy. Nail or screw the tops to a length of two-by-two (a 4′ piece will hold at least 16). Then pivot on lag screws to two uprights.—*Frank A. Javor, North Bergen, N. J.*



Pipe Clamps Make Tool Rack

TOOLS with slender shanks can be held neatly on the wall with pipe or conduit clamps. Overlapping the ends, nail as many up as you have tools to rack, and add to them as your tool collection grows.—*Philip E. McCafferty, Stanwood, Iowa.*

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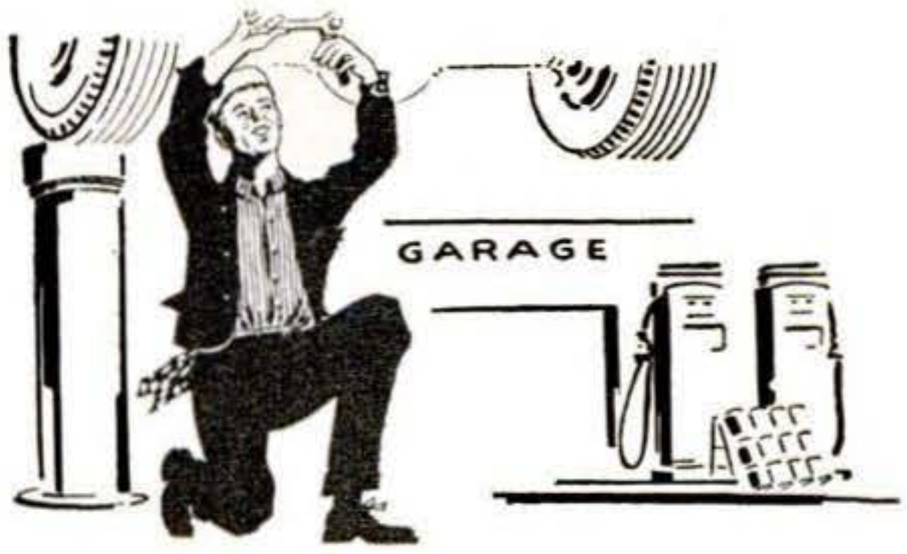
Put your skills to work



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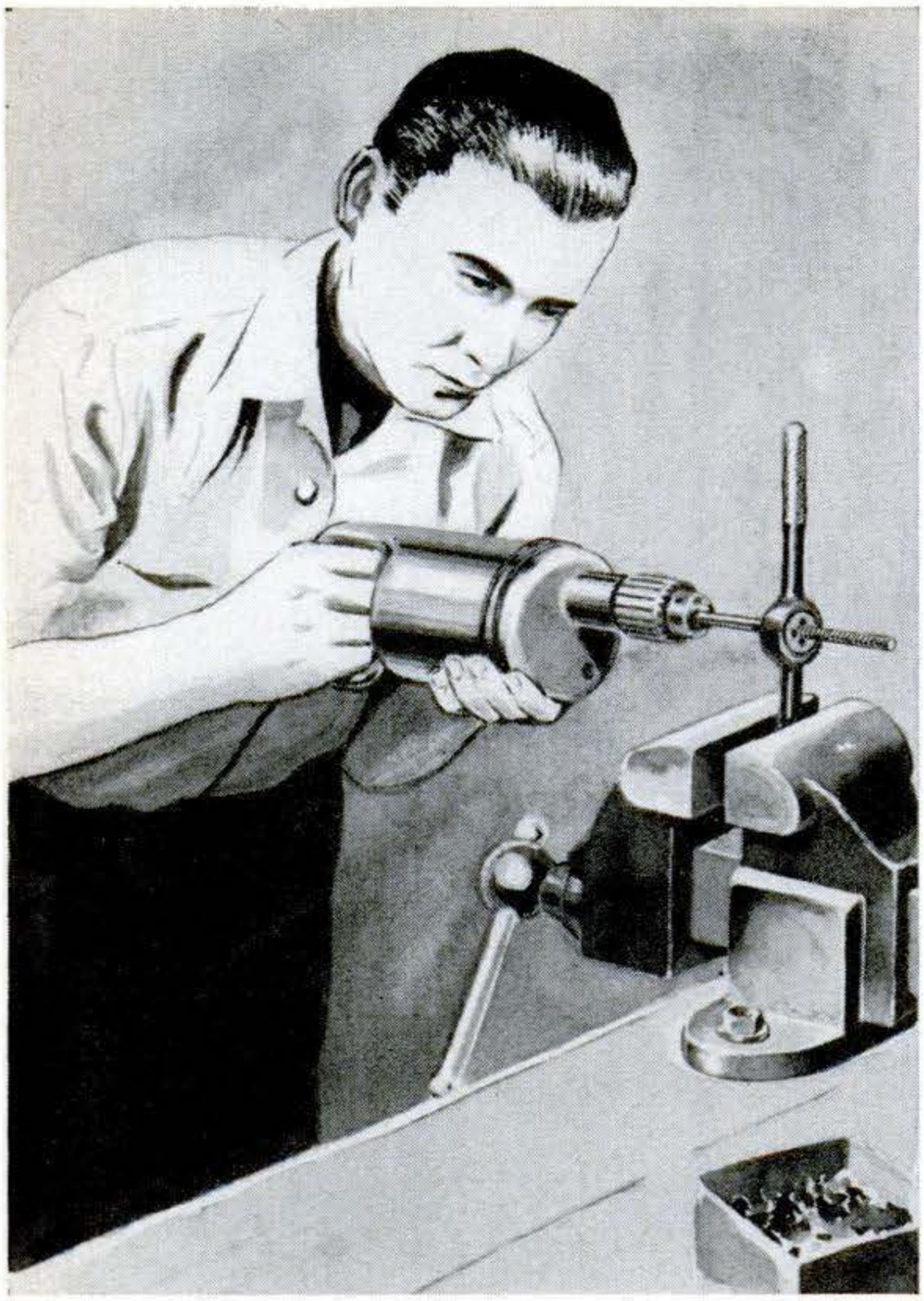


NEW Shop Ideas

Drill Cuts Long Threads. An electric drill makes short work of long threads. Needing several rods threaded for 14″ of their length, I started the die on each true and square by hand. Then I clamped the die holder in a vise, chucked the rod in my electric drill, and ran the threads on by power. It took only 20 minutes to thread 16 rods.

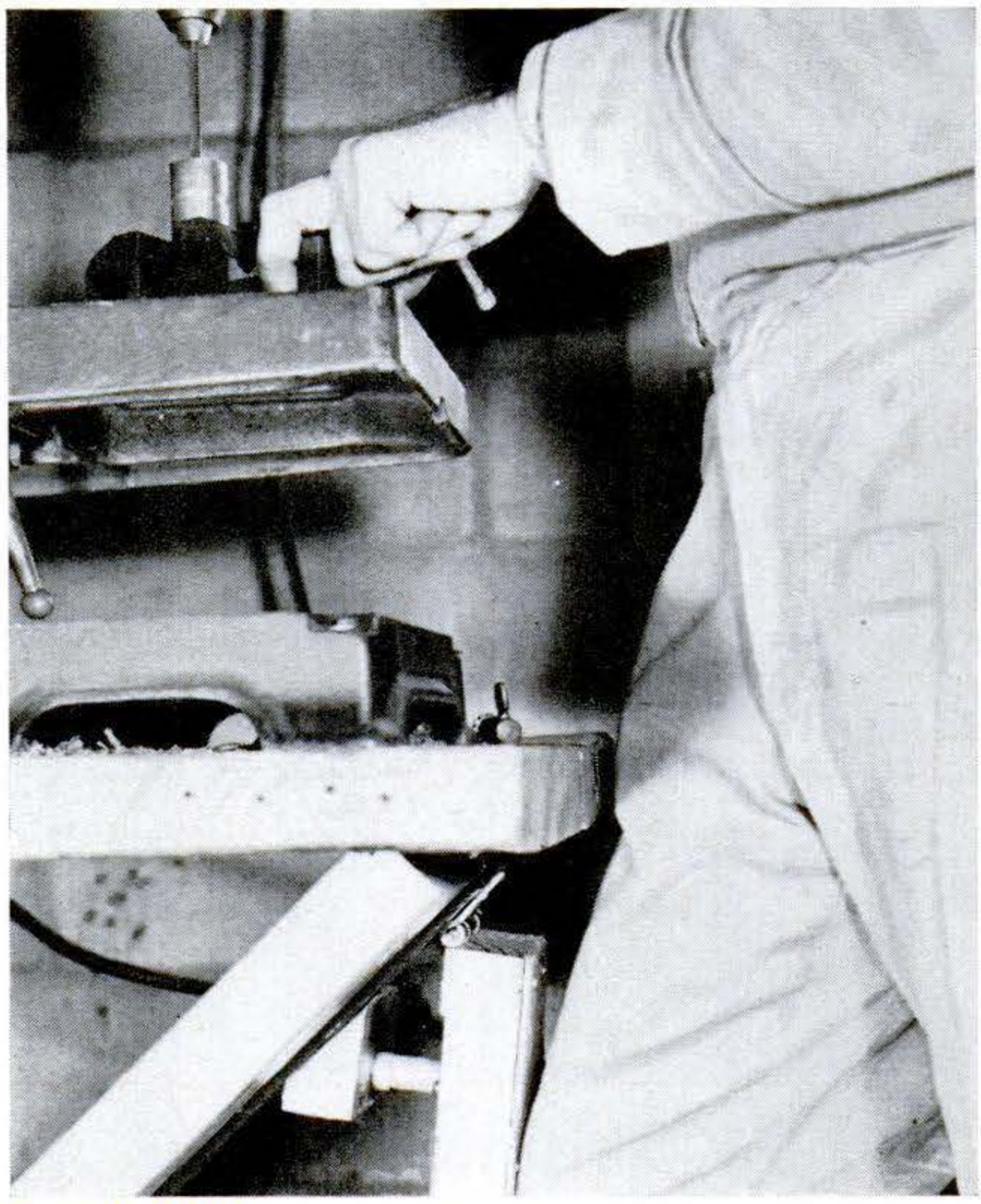
A heavy-duty drill is needed to thread steel rod above ⅛″ in diameter, especially with coarse threads.

Use plenty of cutting oil, and stop frequently to clear the die of chips. To back the die off quickly, reverse it in the vise and chuck the threaded end of the rod in the drill.—*Carl M. Dungan, Kettle Falls, Wash.*

Knee Runs Drill Press. A knee switch acts as a third hand to turn the machine on when your hands are full. It's better than a foot switch because you never have to grope for it.

I wired a normally open push-button switch in series with the regular one, fastening it on a short two-by-four hinged to the drill stand. A small block of wood was mounted in front of the switch to push it against. You could also put the switch on the stationary member and the push block on the hinged one. In either case, locate the knee block far enough back so that it requires a deliberate effort to press it, not merely casual contact.

Be sure to turn off the regular switch each time you set up work or change drills. With practice, you can use the lowest speed to do power tapping, jogging the switch until the tap reaches correct depth.—*Phil McCafferty, Stanwood, Iowa.*



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For greater driving safety, one control now operates MoPar windshield washers and wipers

YOU CAN KEEP YOUR HANDS ON THE WHEEL . . . forget about fumbling for a wiper knob when you want a clean windshield. Just touch your toe on the foot button of the new MoPar "Jiffy Jet" windshield washer. Twin nozzles start to spray . . . wipers start to clean . . . *simultaneously, automatically.* Wipers will keep cleaning after spray stops until you release foot button.

STRONG SPRAY EVEN ON HILLS or when passing. That's because "Jiffy Jet" does not depend on engine vacuum like most windshield washers . . . won't dribble or stop when you accelerate. Spray pressure at the nozzles is *3 times* stronger than with most washers, too . . . blows out dirt that might clog nozzle openings otherwise.

MOPAR ISN'T JUST THE NAME OF A WINDSHIELD WASHER. It identifies thousands of parts and accessories especially designed for your Plymouth, Dodge, De Soto, or Chrysler car or Dodge truck. Drive in where you see the MoPar sign for the finest in parts and accessories.

GET THE NEW "JIFFY JET" from your nearest Plymouth, Dodge, De Soto, Chrysler dealer or wherever you see the MoPar sign. And look for the MoPar label whenever you want the *official* Chrysler Corporation parts and accessories. They are all factory engineered and inspected to *fit right, work right, last longer.*

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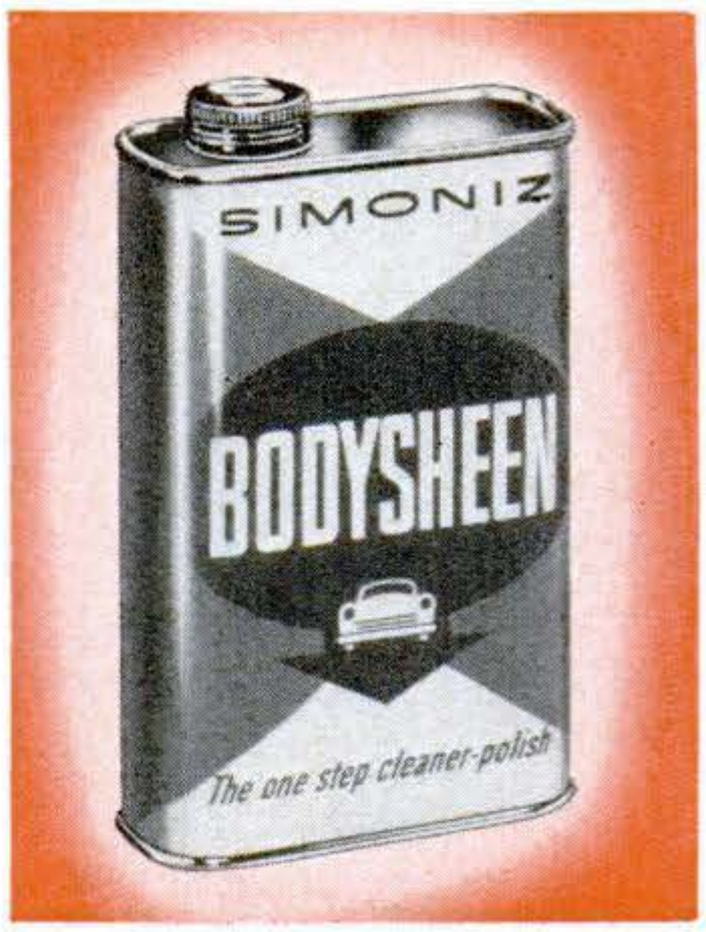
Wizard "Twin-Fire"® patented spark plug gives top performance twice as long as single electrode plugs. Each electrode fires one at a time while the other "rests", stays accurately gapped up to twice as long. Guaranteed 18,000 miles. Each, in sets..... **75c**



The one-step cleaner-polish! New Simoniz Bodysheen cleans and polishes, in one easy step. Just wipe on, then wipe it off! Brings out natural brilliance, enriches colors. Gives your car a long-lasting, weather-resistant finish. (3P7113)..... **98c**

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Hardwood — 48" (C5229) Pr. **$6.35**

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Don't be stranded by a worn-out fan belt. Replace now with a Wizard extra-quality Fan Belt. Inner core of endless rubber impregnated rayon cords. Tough rubber cushion reduces heat, assures long life. Can't slip, stretch. Guaranteed fit. (T9105-9209) **69c** up.

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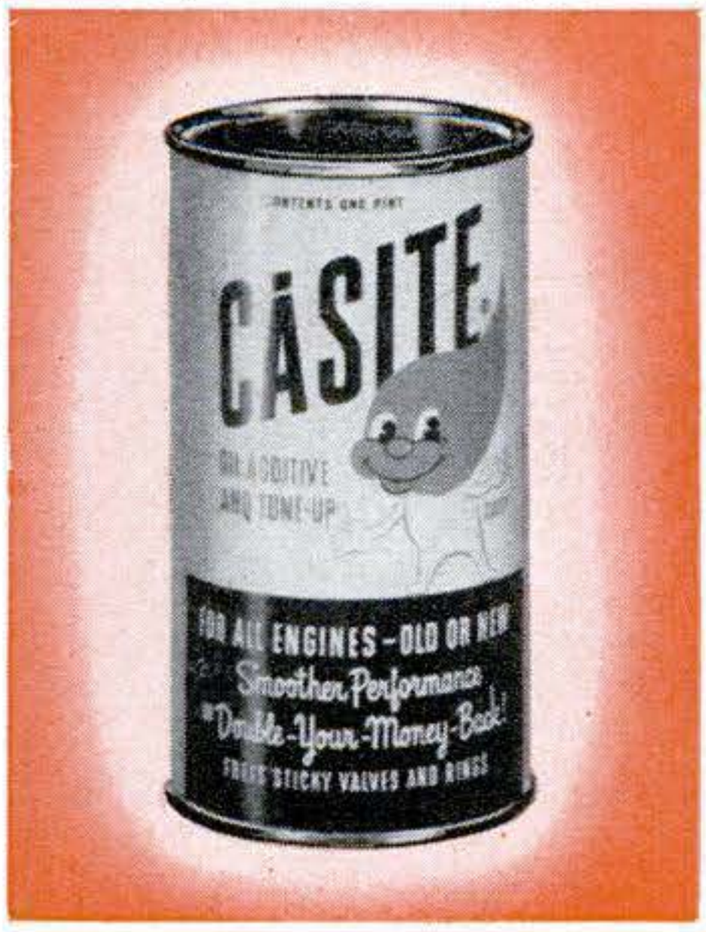

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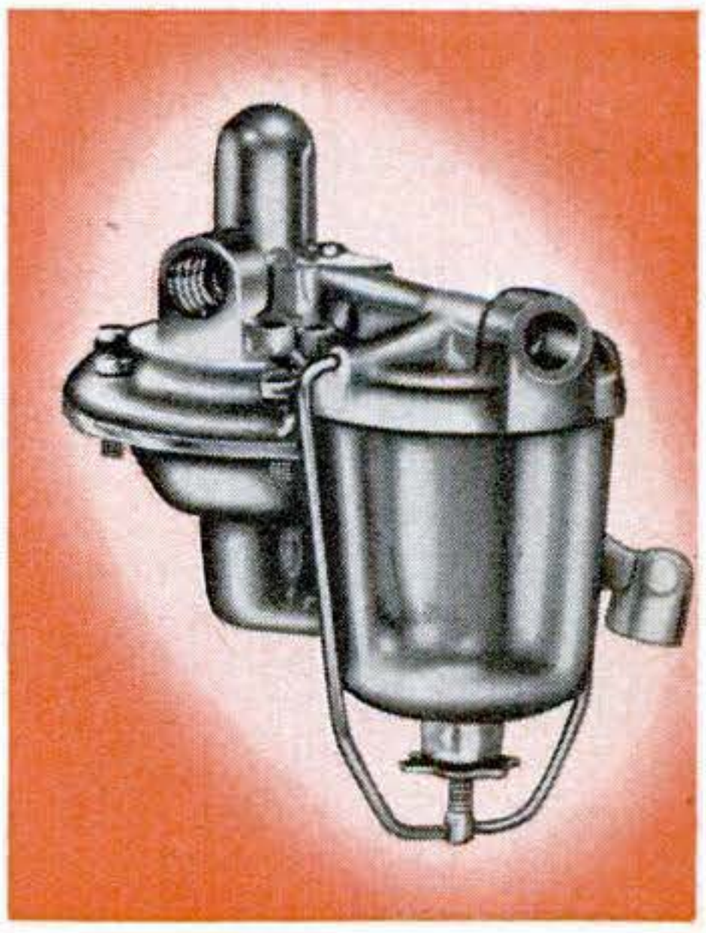

Wizard Fuel Pumps, guaranteed for long, dependable service. Original equipment replacement. Diecast body; precision machined surfaces and parts; fully tested. Extra high quality diaphragm for longer life, top performance. For all popular cars. From **$2.69**

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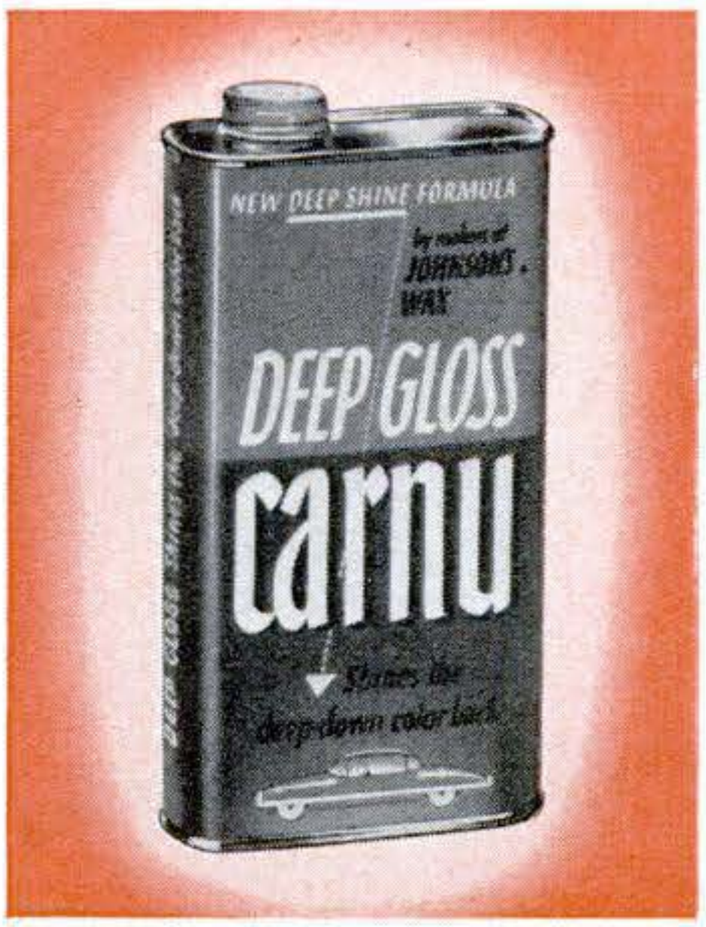
Chrome Exhaust Deflectors and Extensions add beauty to your car. Keep exhaust off bumper. Easy to attach . . . fit most cars. Western's Exhaust Deflector; simple, flared design (CR2806) **53c**
Exhaust Extension (8" x 2½"); straight-tube type. (CR2807) **$1.19**



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Drednaut Hydraulic Jack takes work and danger out of tire changing. Easy wrist-action lifts any car. Twist—it's down, safely and smoothly. Precision built for most severe transport service requirements. 7" high, raises to 14¼". With handle. (A6188)....**$9.25**

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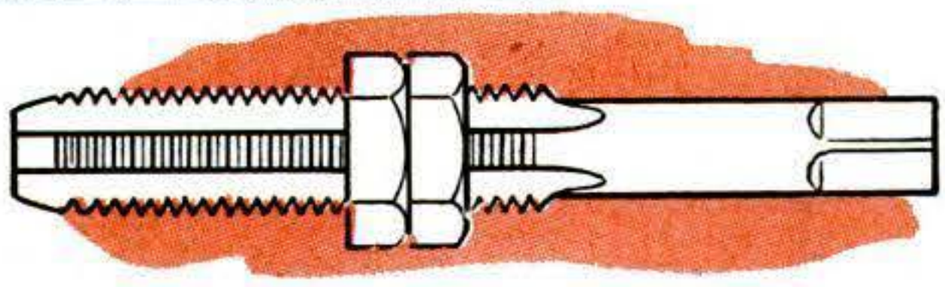
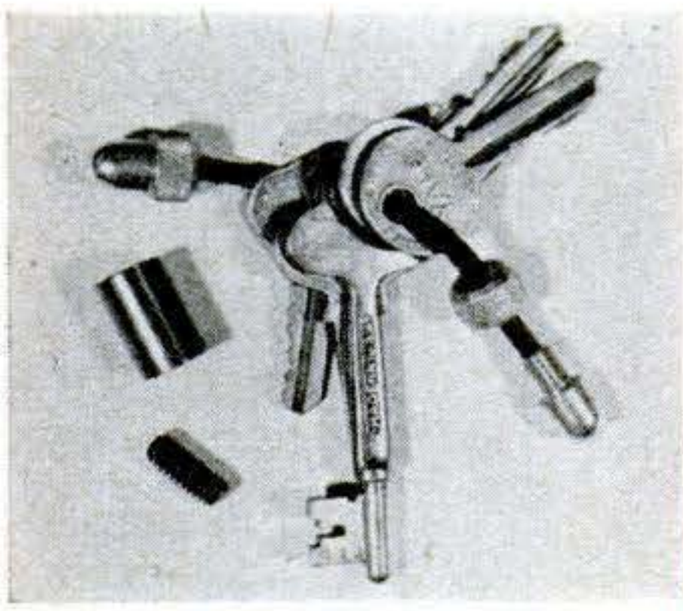
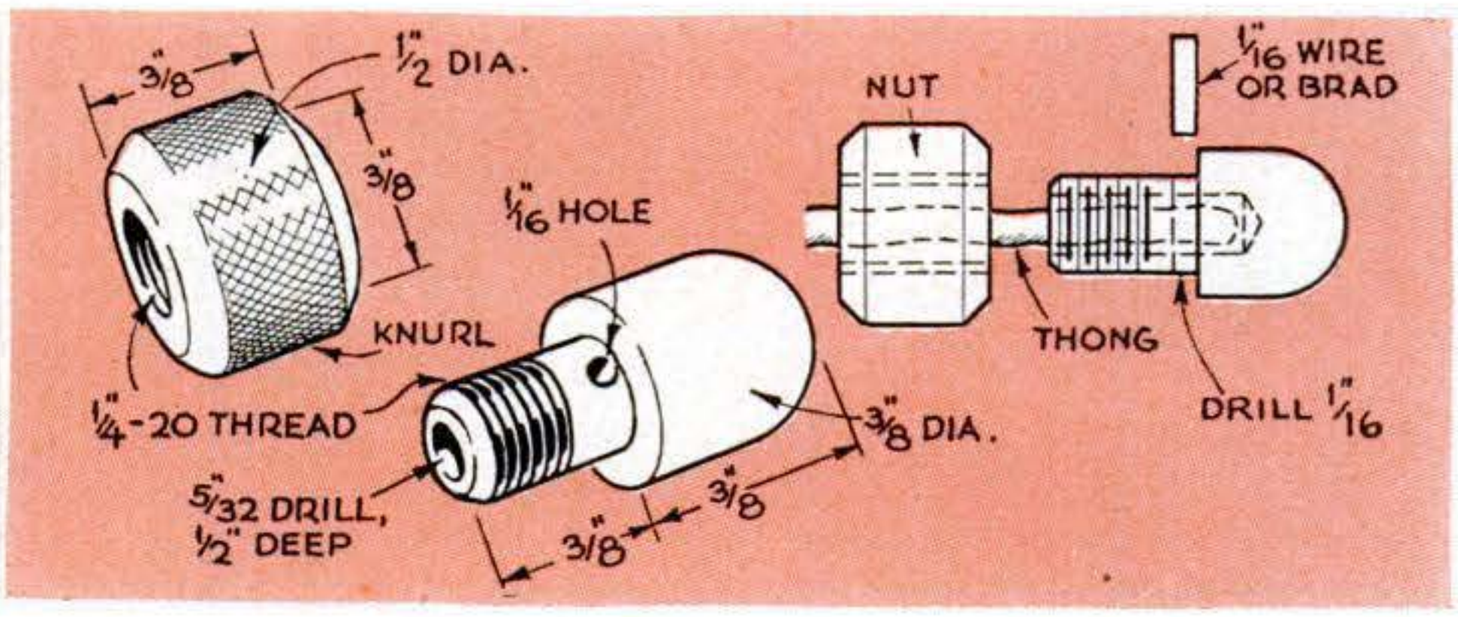
MORE SHOP TIPS



Nuts Gauge Tap Depth. If you want the same thread depth in a number of holes, run two nuts up on the tap as shown. Measure the desired thread depth from the first full tooth on the tap to the bottom nut, and lock the other nut against it. Turn the tap until the lower nut just lightly touches the work.—*Frank La Saracina, NYC.*





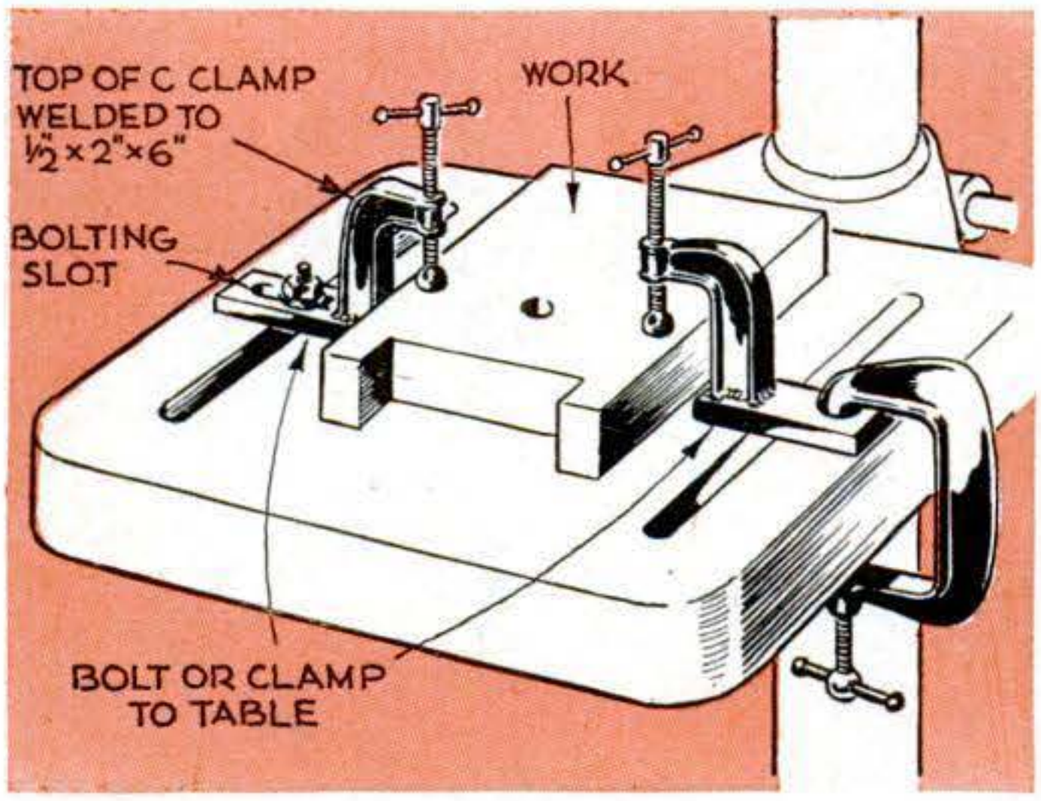
Acorn Key Holder. Making this pocket piece is good lathe practice and fun besides. It lets keys lie flat in pocket or purse, and keeps them in a definite order for easy selection.

For the nuts, chuck ½″ aluminum, brass or dural rod, knurl for 1¼″, drill through No. 7 and tap ¼″-20. Face and chamfer the end, cut off ⅜″ long, and repeat to make two pieces. Then lay them aside.

Chuck ⅜″ stock for the screws. Turn down, thread, and drill ½″ deep. Cut off ¾″ long and make a second similar screw. The cutoff faces are next finished separately.

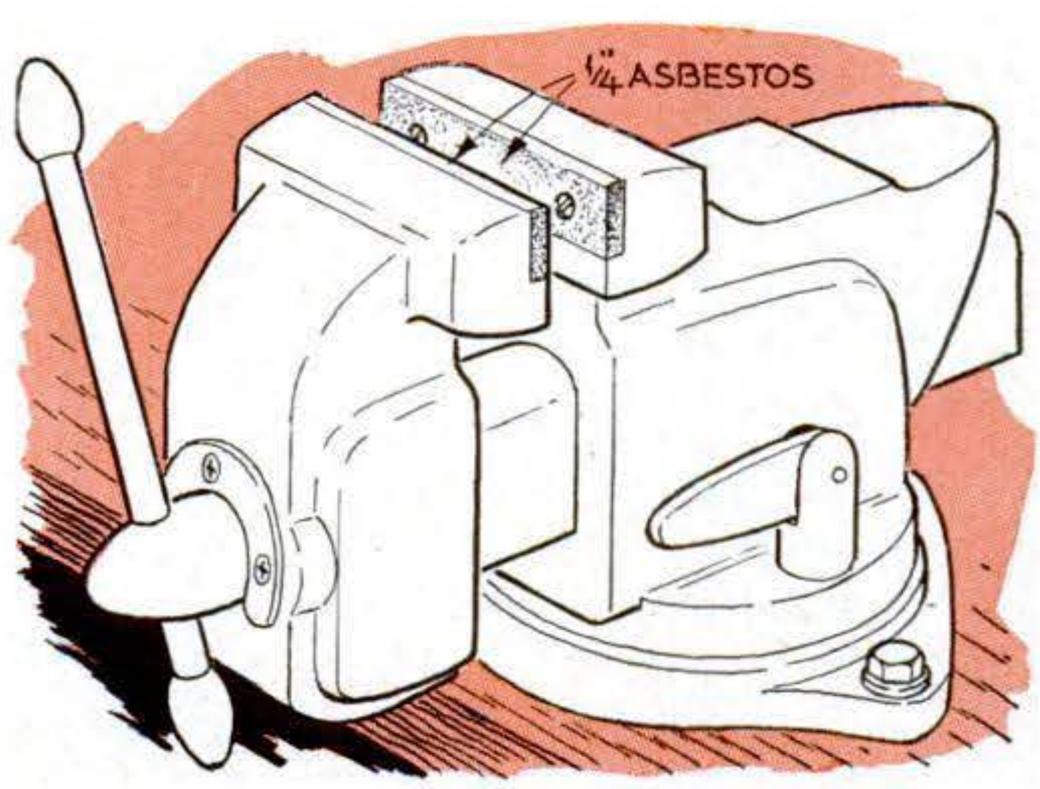
To hold the pieces for finishing, make a simple chuck by tapping a bit of scrap rod and chamfering the end to ⅜″ diameter. Counterbore the tapped hole, turn each screw in tightly, and file its end round. Drill a 1/16″ cross hole through at the shoulder. Mount each nut on the chuck with a headless bolt to chamfer the unfinished end.

Slip both nuts onto a 4″ leather thong, push each end into a screw, and pin it through the cross hole. Tighten the nuts to lock the pins.—*John M. Avery, Dexter, N. Y.*



Holding Drill-Press Work. Here's a good use for broken C clamps. Weld the screw ends to pieces of strap iron for clamping work to the drill-press table.

Once these clamps are set up, duplicate pieces are held or released by a twist of the screws, and there are no awkward loose straps or nuts to handle, mislay or drop.—*C. H. Willey, Penacook, N. H.*



Asbestos Heatproofs Vise Jaws. If your vise draws so much heat from work held in it that welding, brazing or soldering is difficult, replace the jaw inserts with pieces of asbestos block for such jobs. Attach them with the same bolts that hold the regular inserts. Countersink the holes well. Hacksawing shallow kerfs crosswise provides a nonslip surface.—*George P. Klewins, Chicago.*

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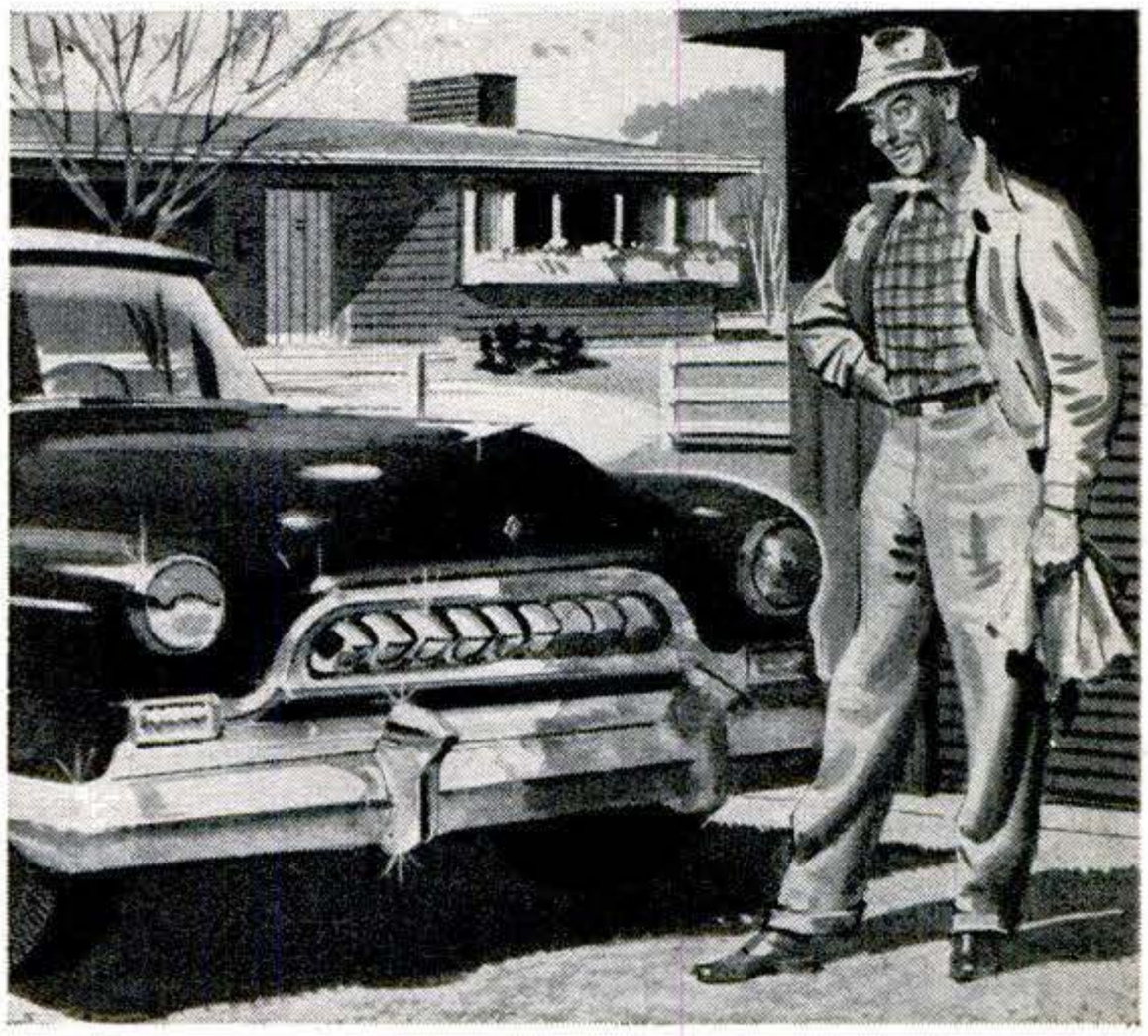
Texaco Tips On Car Care

Easy way to remove rust from car chrome

Use very fine steel wool, applied with plenty of "elbow grease"—but be sure to stay away from body paint. To remove road oil or asphalt spots, go over them with a little kerosine on a clean cloth. Then, for a bright, attractive gloss that stays rust-free, add a protective coating of car wax and give the chrome a final rub-down with a soft cloth.



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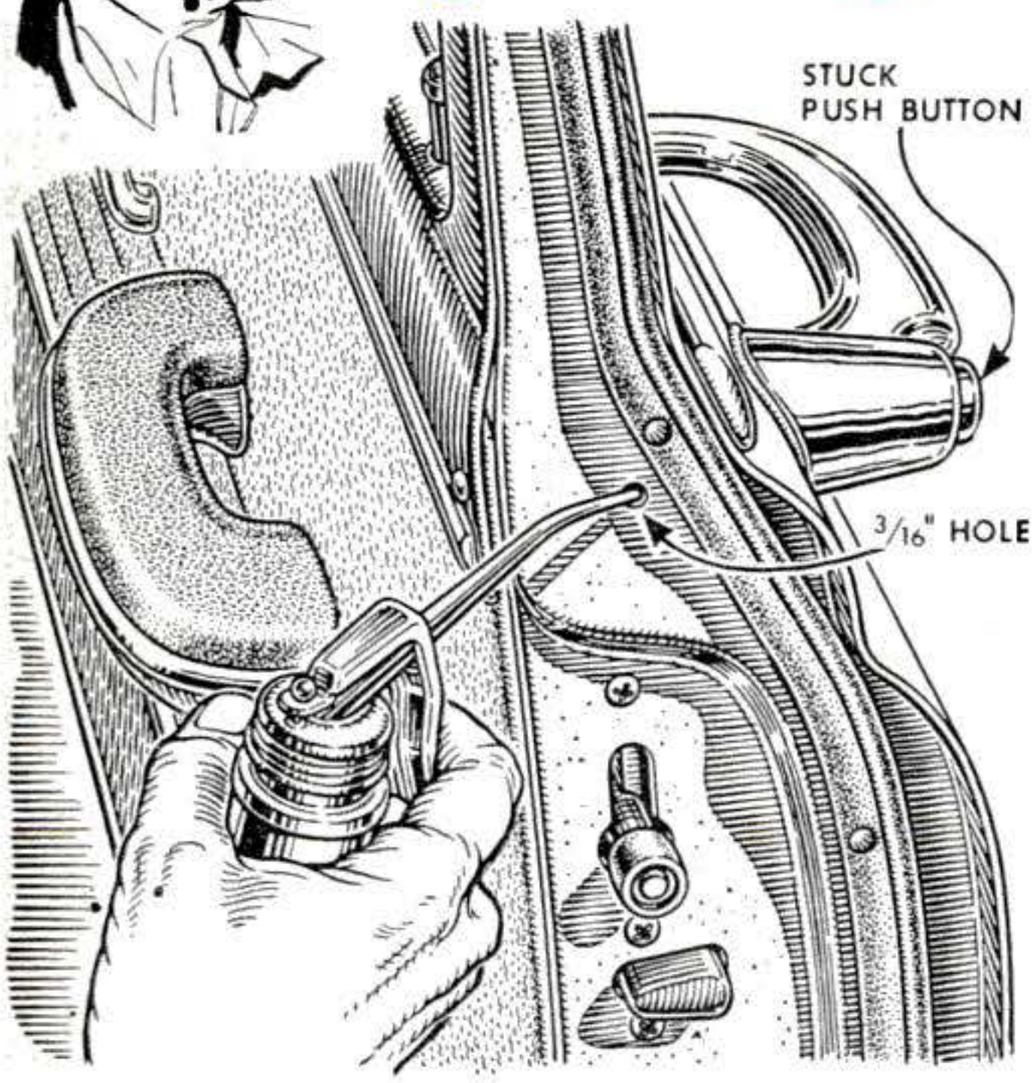
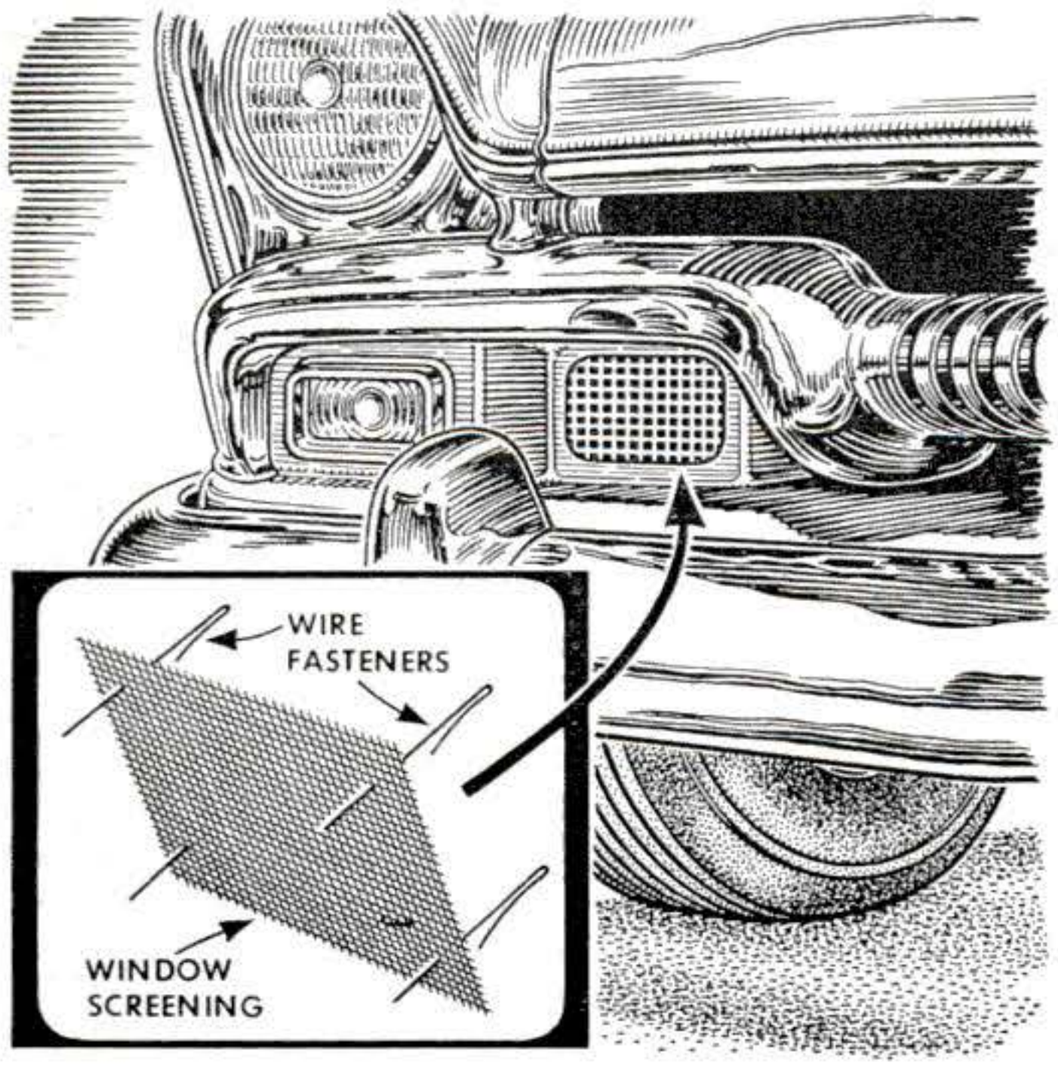
Hints FROM THE MODEL GARAGE

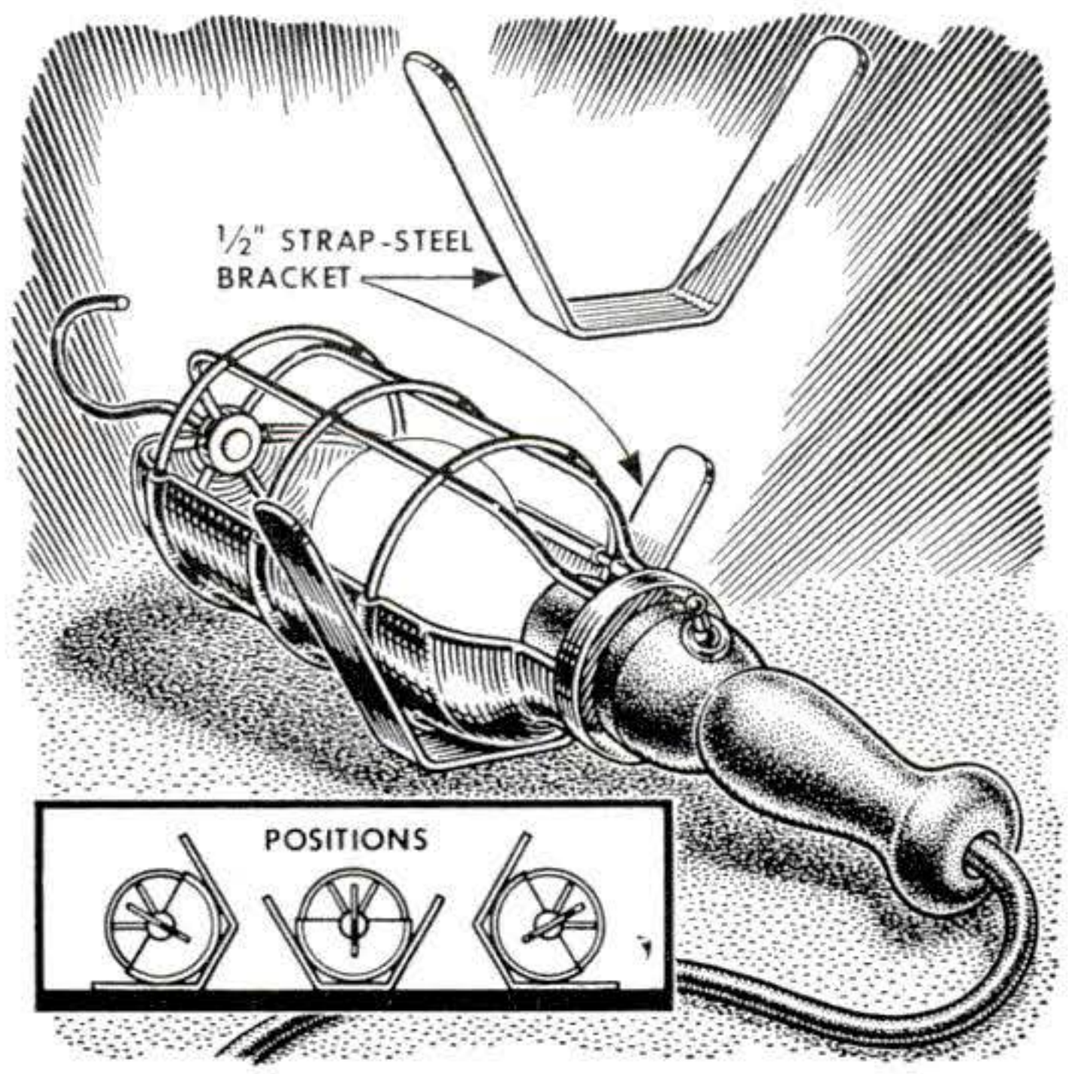


Freeing a stuck push button, on some cars requiring removal of the entire door panel, is easy if you drill the door edge in line with the latch contact. Squirt in penetrating oil to remove rust, then lubricate regularly with graphite.

To keep track of gas consumption, record the date, mileage and gallons bought each time you stop. Notes can be jotted on masking tape on the top edge of the door. When one strip has been filled, pull it off and stick another in its place.



Window screening will keep small insects from getting into your car through the heater and ventilating air-inlet grilles. It can be fastened to the coarse-mesh openings with hooked wires pulled back through, as pictured in inset, and then twisted tight.



To keep a work light in place when you use it under the car, weld or bolt a bracket to the shield on the guard. It will then give light where you want it and won't roll from place. The flat sides allow concentration of light in any of three positions.

Please turn to page 232 for more auto hints

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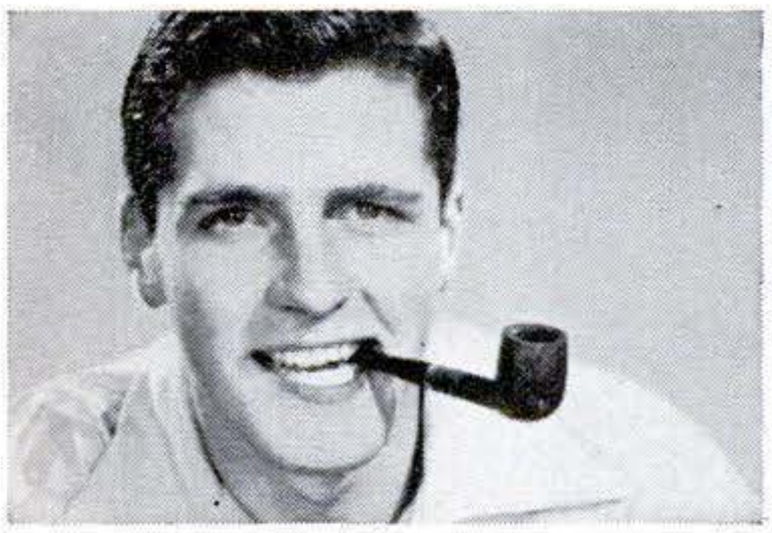
Some brands give you shorts and bits which burn like tinder—fast and hot.

Others give you fine-cut shreds — good for cigarettes, but not so good for pipes.

Only Edgeworth gives you slow-burning "chunks" made for pipes and pipes alone.

PIPE SMOKERS: COMPARE THE CUTS OF TOBACCO AND SEE

Why Edgeworth Smokes Coolest



Edgeworth's Way with White Burley Has Never Been Equalled

Your true tobacco expert will tell you that white burleys are the world's coolest smoking tobaccos. Edgeworth is a blend of white burleys only—aged like fine wine, for years. Of course, other tobaccos use white burley, too—but nobody else has yet found out just how to blend and process tobacco to give it the even-burning, cool-smoking character that Edgeworth "Ready-Rubbed" has maintained.

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This Amazing Pouch Means Cooler Smoking!

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Get this new polished aluminum stem "Park Lane" pipe with interchangeable imported briar bowl and exclusive "*dri-dome*" moisture trap—along with 2 full-sized pouches of EDGEWORTH tobacco. If your dealer cannot supply you, use this handy order blank.

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Edgeworth

AMERICA'S FINEST PIPE TOBACCO FOR OVER HALF A CENTURY

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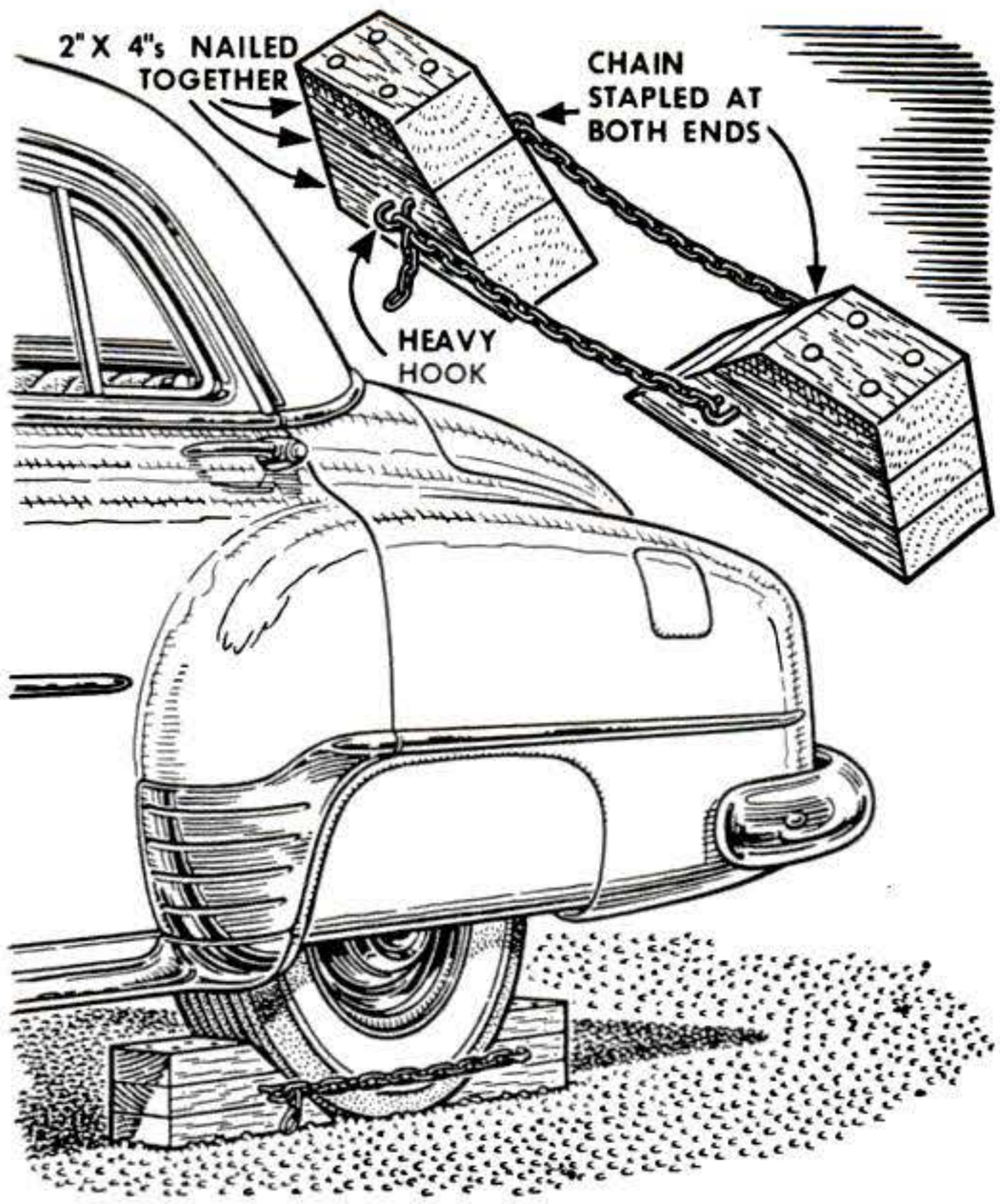
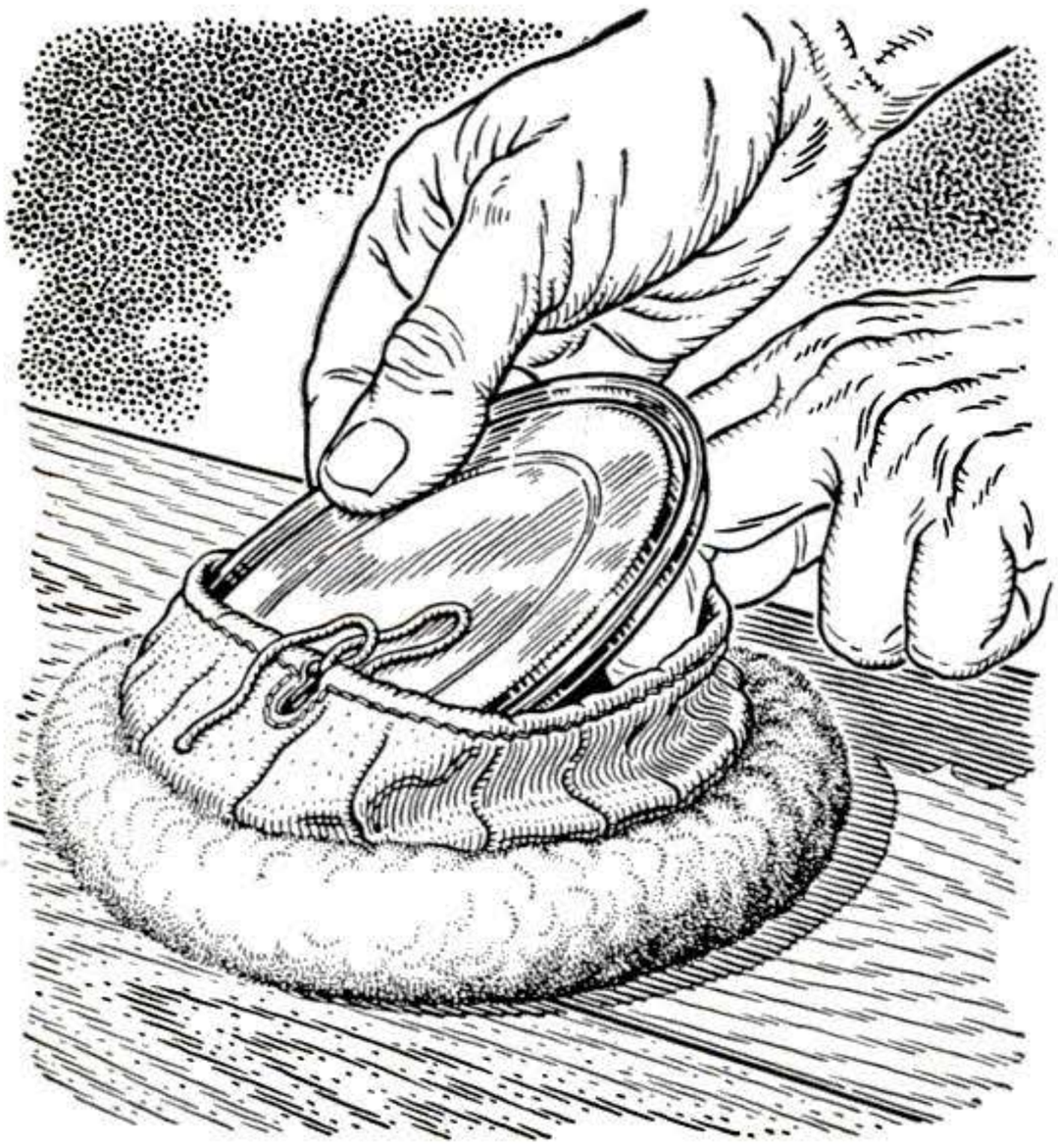
MORE Hints from the Model Garage

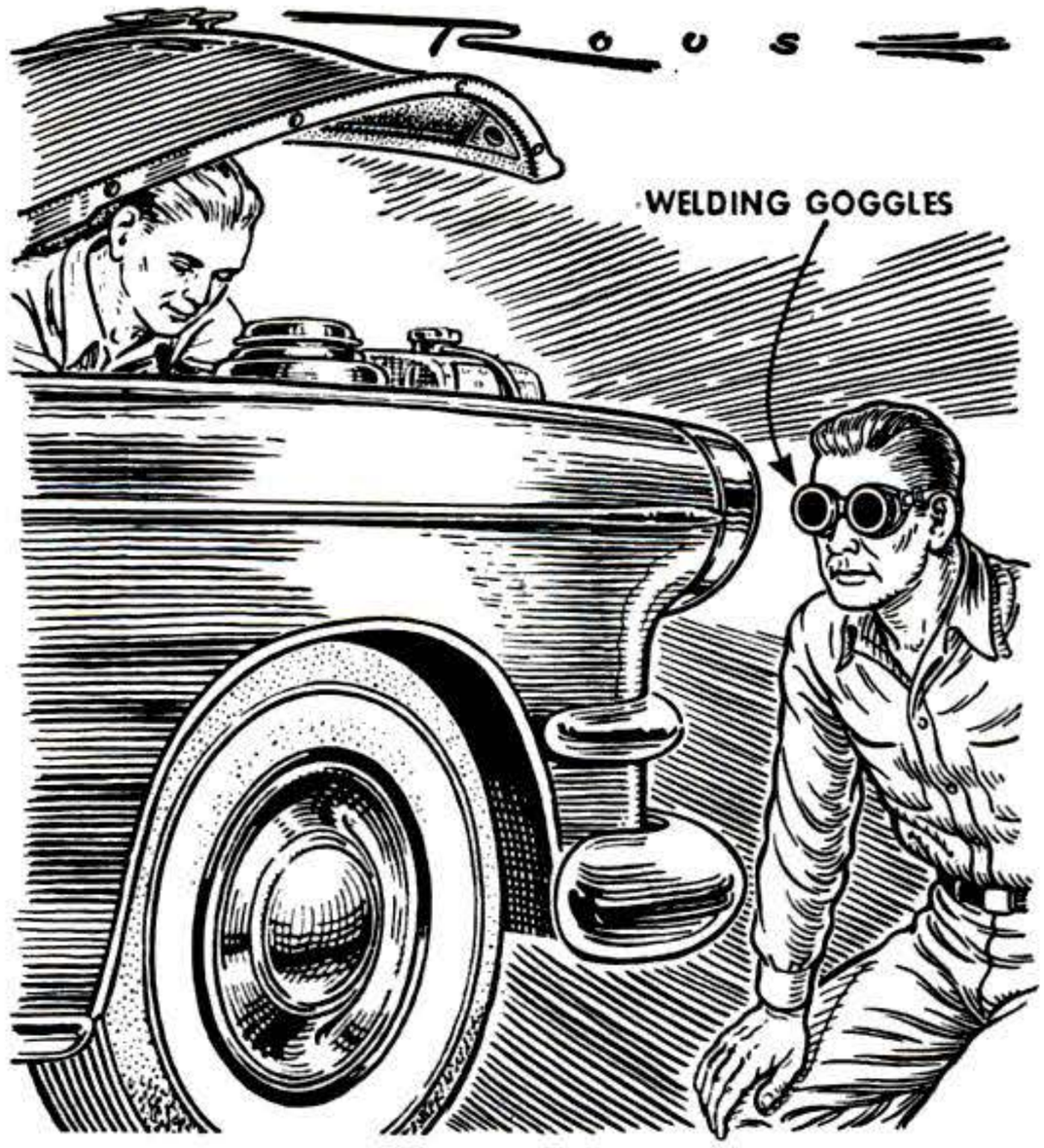
Soaking a new radiator hose in hot water helps to make it pliable. Then you can slip it more readily onto the radiator and cooling-system connections, especially when they are so close together that working with a stiff hose becomes a difficult job.



Chocking a wheel is a good safety practice when you change a tire or do other repairs with the car jacked up. A set of chocks made from scrap lumber and chained to fit snugly in front of and behind the wheel is a handy aid to carry in the trunk.



When the lamb's-wool bonnet of your electric buffer needs cleaning after polishing the car, a suitable tin-can lid used as a drying form will prevent shrinking. Wash wax and dirt out of the bonnet, and slip it over the lid, leaving it on until dry.



Welding goggles worn by a helper when you are working on the lighting system will enable him to look directly at the sealed-beam filaments as you test the wires. He can detect flicker in either filament without suffering any damage to his eyes.

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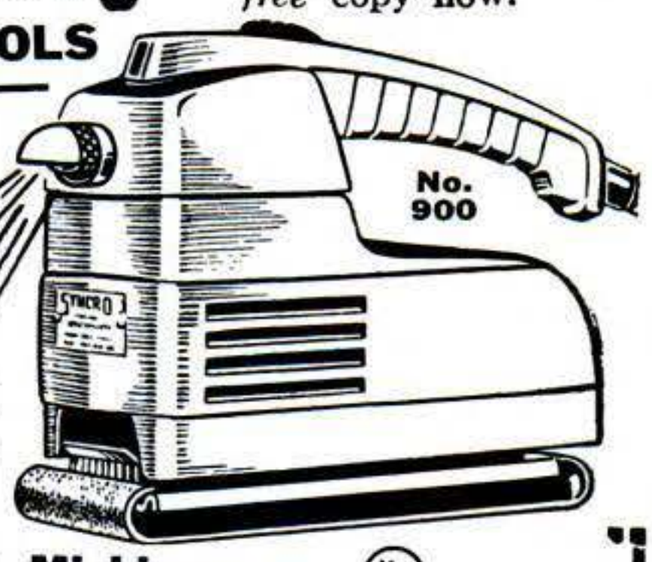

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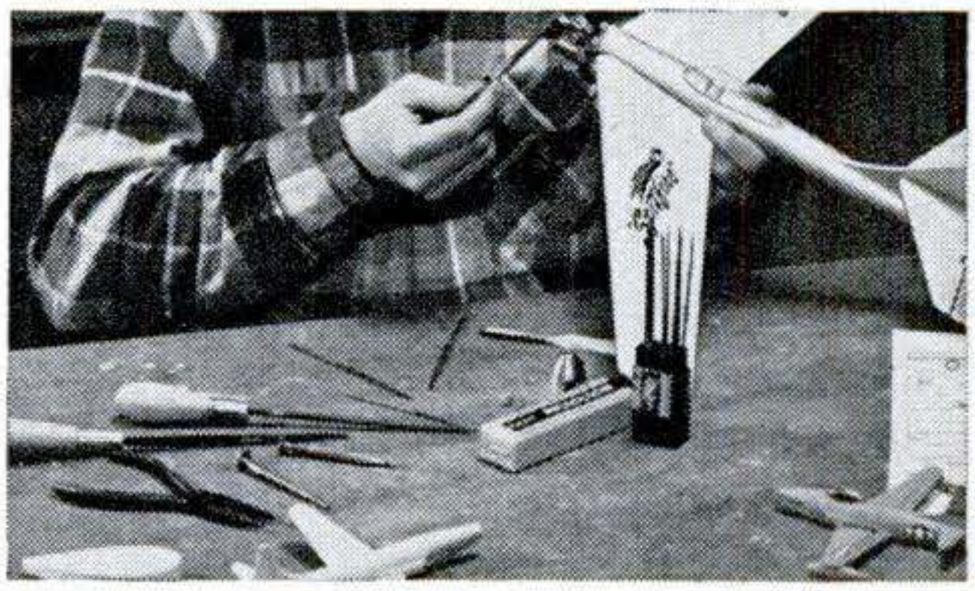

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[Continued from page 160]

of the motor with his shop light. The shop light was too bulky to be moved about among the rods, so he fumbled out his pencil light, began to play its beam along the shaft.

The brilliant beam of the pencil light was reflected from a tiny bright spot on one of the center crankshaft counterbalances.

"Ah!" Gus breathed. "Now what caused that? Maybe the counterbalance has been striking the oil stick."

GUS grunted as he turned the shaft over slowly. No, the counterbalance hadn't been striking the oil stick. There was nothing near enough to strike the counterbalance. And what if there was? It would strike all the time, not just on hills.

Gus was inclined to disregard the bright spot on the counterbalance. Maybe, he thought, he'd scraped the power-bar handle across it when he was taking down the rods.

Another drop of oil fell from the oil float. It just missed Gus's left eye. He snorted as he wrung a greasy knuckle in the eye socket. Then he relaxed and just lay there, looking up at the offending oil-suction float, thinking of knocks that didn't come in for a month, even on hills, and then suddenly came in, and only on hills. He reached up to waggle the oil float up and down for the length of its travel on its movable arm. He crawled out to call Scott Service.

"Scott," he said, "this is Gus Wilson. You've been servicing Hank Stoneman's Jeep. How is she on oil?"

"Fine," Scott replied. "That Jeep don't use hardly any oil. It was down a quart when Stoneman bought it, but seeing that he was soon to start on this uranium-hunting expedition, we didn't add any. We changed the filter and filled her to the mark with new oil last night."

"Thanks, Scott." Gus hung up.

He was like a hound on a hot trail now. He slid under the Jeep and began taking off the oil-float assembly. As he had expected, there was a bright, dented spot on the top. He took the assembly to the bench and worked on it a moment, washed it out, crawled under and replaced it. He slapped up the pan, reached a brawny arm out to his tool kit for a speed wrench. Something in his movements seemed to communicate a sense of success to the Stonemans. Nancy came to squat down and peer under at Gus. Hank hastened to join her.

"Please hurry, Gus," Nancy pleaded. She added wryly, "We're late for our honeymoon."

Gus smiled cheerfully. "I'll have you on your way in minutes."

"What in tunket was it?" Hank asked.

"The oil float," Gus said out of the corner of his mouth as he worked to buckle up the pan. "It works on a movable arm, with a stop that lets it float only so high. This stop has been bent so that the float bypassed it, going so high that one of the crankshaft counterbalances struck it . . . that knock didn't sound quite like a rod to me."

STONEMAN was puzzled. "But why did it strike only on hills—and why didn't it strike until we started our trip?"

"That's what had me fooled," Gus chuckled. "It didn't strike before because you were a quart low on oil. It didn't strike even after Scott had filled the pan with new oil to the high mark, until you hit a steep hill. Then the oil ran to the back of the pan and raised the oil intake float high enough so that it did strike. I simply bent the stop back again so it couldn't be bypassed."

Gus chuckled again. "I couldn't find it until it almost spit in my eye. Things like this sure get me down."

Stoneman laughed. "Don't kid us, Gus. You love it."

"Maybe," Gus said ruefully, "but I sure do get frazzled around the edges sometimes. There, the pan is on. In with the oil and you're on your way. Meeker Springs, here you come." END

NEXT MONTH: Gus turns back the clock.

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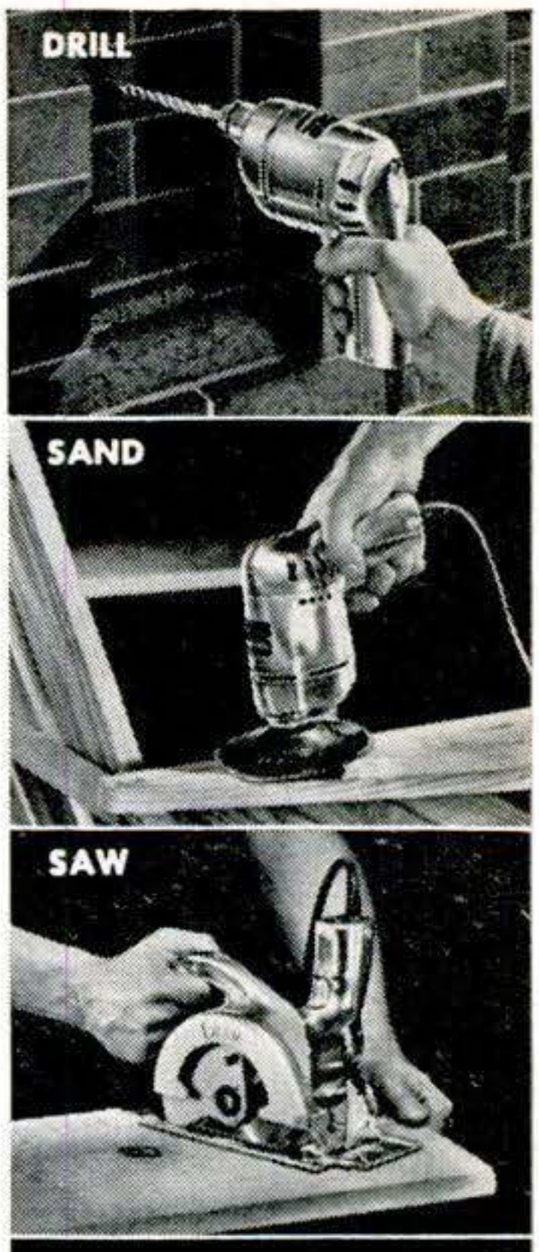

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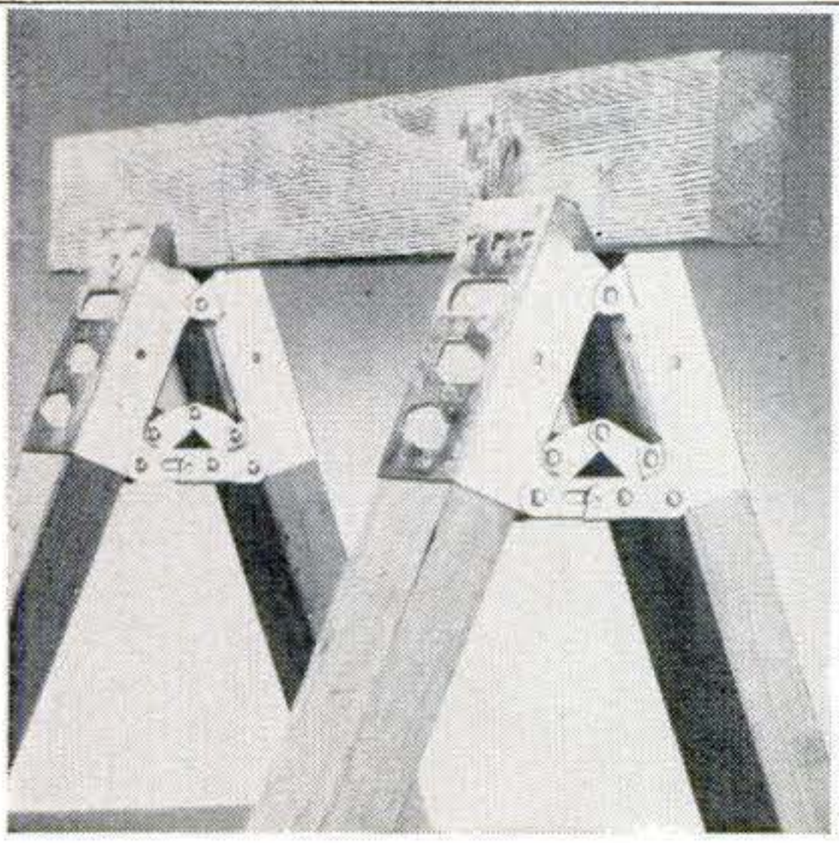

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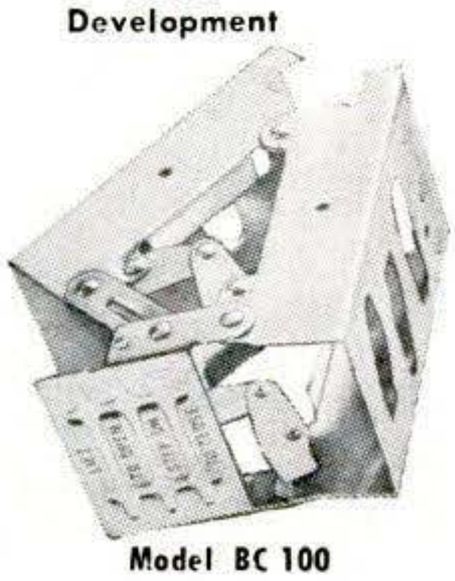

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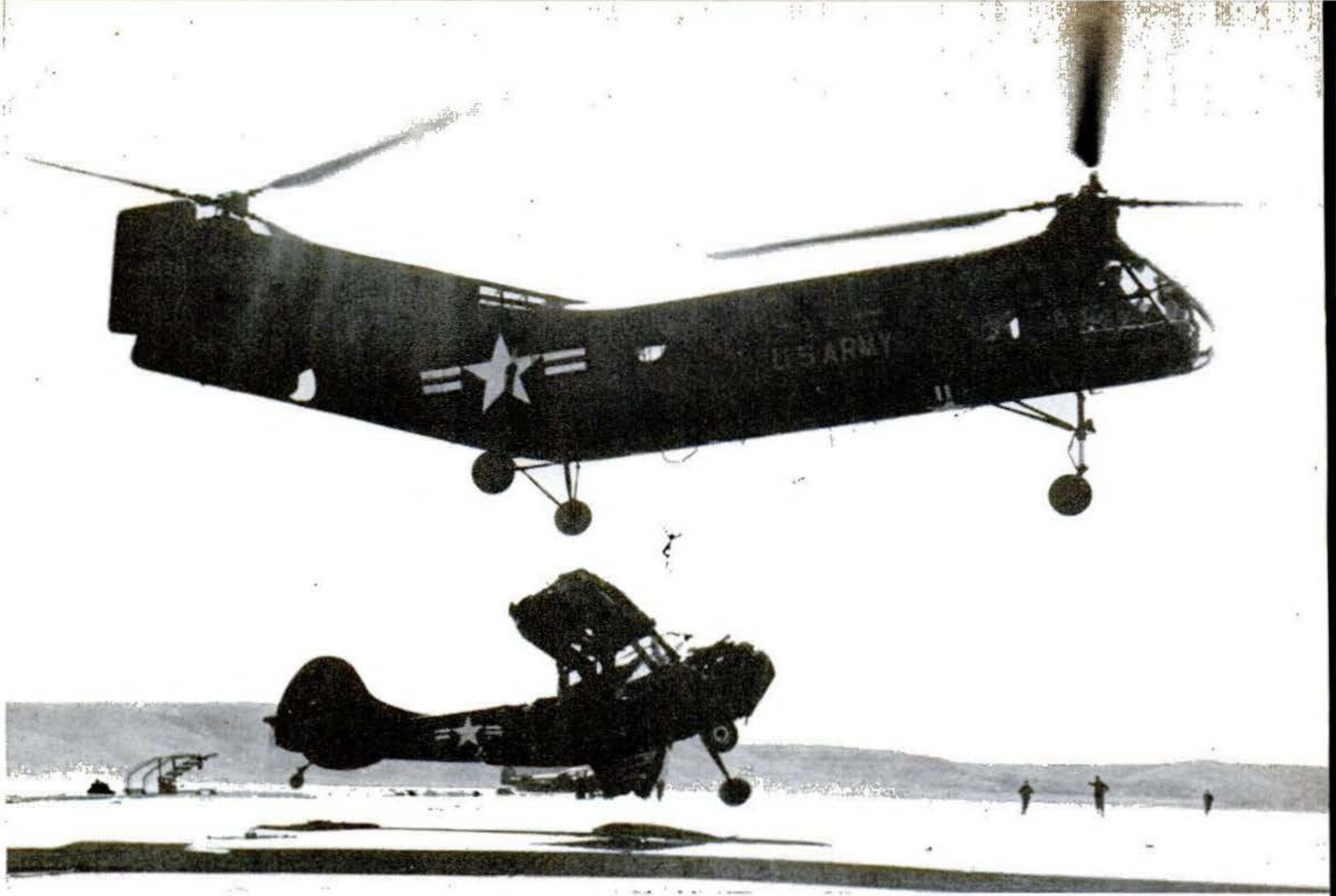


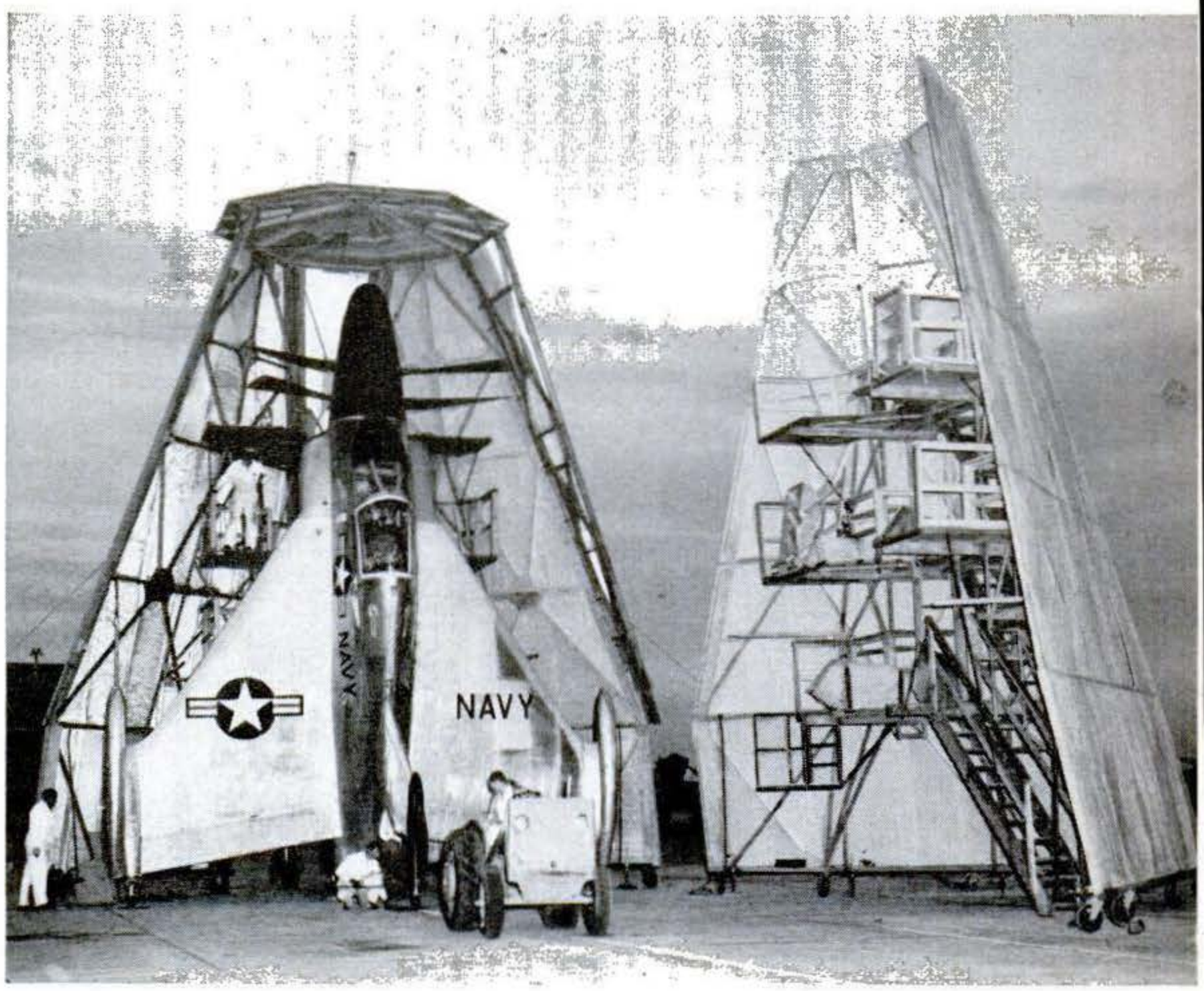
Big Airborne Wrecker Salvages a Cracked-Up Army Plane

THIS copter is bringing home an L-19 Army aircraft that crashed on a Kansas River sand bar. A salvage crew flown in by the big Work Horse threw a cable sling around the fuselage of the crippled plane and hooked it up with cables dangling from the airborne wrecker. Seconds later the L-19 was back in the air—under helicopter power.

Tepee-Shaped Hangar Suits Pogo's Contour

NO INDIAN chief ever had as fancy a wigwam as this one on wheels that houses the Pogo plane. The 36-foot-high hangar opens up like the two halves of a clamshell to take in the vertical take-off fighter in its normal parked position—on its tail.

Stairways connect three built-in work decks from which ground crewmen can service any part of the plane. It's the smallest hangar ever designed for the Navy. Convair built it.



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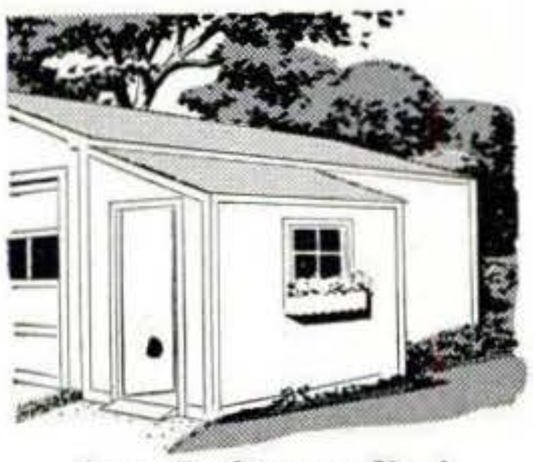

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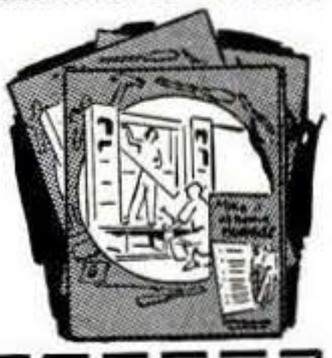

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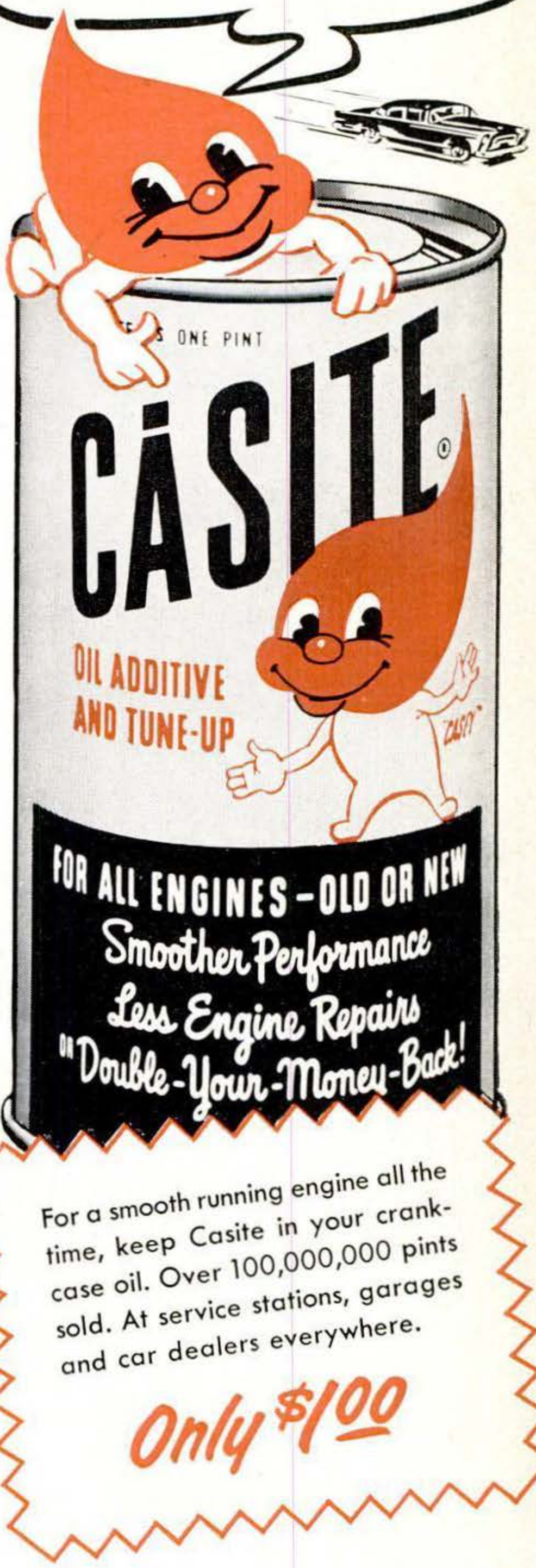

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[Continued from page 120]

dent a few days before. The treasured 4.5, with its graceful body and expensively reworked engine, was lying hopelessly smashed in a Georgia village. On the trip down, its trailer had jackknifed; the Ferrari had been tossed into the air and had rolled four crunching times. The brand-new Mercury wagon towing it had also flipped and was wrecked; the mechanic driving it got only scratches. To a multimillionaire, a $25,000 smash-up is not as traumatic as for you or me; but the loss of the car with the habit of winning depressed everyone.

By late afternoon, Kimberly had racked up 150 miles of high-speed practice. The 4.9 was hitting near 140 m.p.h. on the straight, braking to about 35 as it clawed around the hairpin. Marsh had made countless sharpen-up adjustments. Lap times were shaving down a second or two. A virgin set of Pirelli tires had been fitted before the last practice laps, to scuff them up a little. As Marsh shoehorned the 4.9 back into its trailer, Kimberly gave his verdict:

"Well, without the 4.5, we aren't going to win. Probably aren't going to get taken too badly, though."

Strategy. Over dinner, Kimberly talked a little about strategy. "You win at the end of the last lap—nothing before counts anything. A man can pile up a big lead in just 25 miles if he doesn't nurse his brakes, but he can lose it quick when they fade. Then he *has* to nurse them, and that means five or six seconds a lap.

"Sometimes you go for the lead. Often it's better to lay second or third—depends on who you're up against. Some drivers don't like to be followed closely; it makes 'em jittery to see you hanging there in the mirror all the time. Often you make someone push his car much harder by following than by leading."

"Where do you pass?"

"Depends on the other driver. If he's new and has a smaller car, you try not to surprise him. Suppose he's going flat out at 110, which seems pretty brisk to him. Then you come tearing by much faster, and if he doesn't know you're coming, he's apt to get startled. With your competition, you just take them as you can."

"What if you're just alongside someone when your cutoff point goes by?"

Kimberly grinned. "Well, you're not in a race for the ride. It's all right if the other man is experienced; but if he's some knucklehead who's always going sideways, it can get a little hairy."

The race. The Scuderia unlimbers at its pit with the collective energy of a tent circus staking out. Up on the bridge go rope rails, tables, chairs, awnings, stop watches, lap charts, binoculars. The generator set is put to building up compressed air. Stanchions and ropes are set out to retard casual sightseers. Marsh nursemaids the 4.9 out, running it until the temperatures come right.

He checks the pit like a hostess studying the living room before company comes. Signboard and code numbers leaning against the truck. Air hose coiled correctly. Lead hammer, lever jacks and spare wheels just so. Toolbox, hydraulic jack and loud hailer handy.

There is incessant visiting about. Mechanics borrow tools or ask Marsh to opine over a spark plug. Several good-looking women cook delicious hamburgers on the Primus, serving them on paper plates marked "Scuderia Kimberly" in gold. Briggs Cunningham, Phil Walters, Bill Spear, and numerous others chat with Kimberly, commiserating on the loss of the 4.5. No nervousness is evident among the drivers except, perhaps, for a heightened restlessness.

Tension. Amplifiers order cars and drivers to the line. Along the pits big engines fire up deafeningly and the cars are maneuvered, three abreast and nine rows deep, for the standing start. A mechanic or friend stands beside each driver, bending over to shout last-minute counsel in his ear. A "one-minute" bomb explodes. A collective, heart-pounding tension takes over. Drivers jazz their

[Continued on page 240]

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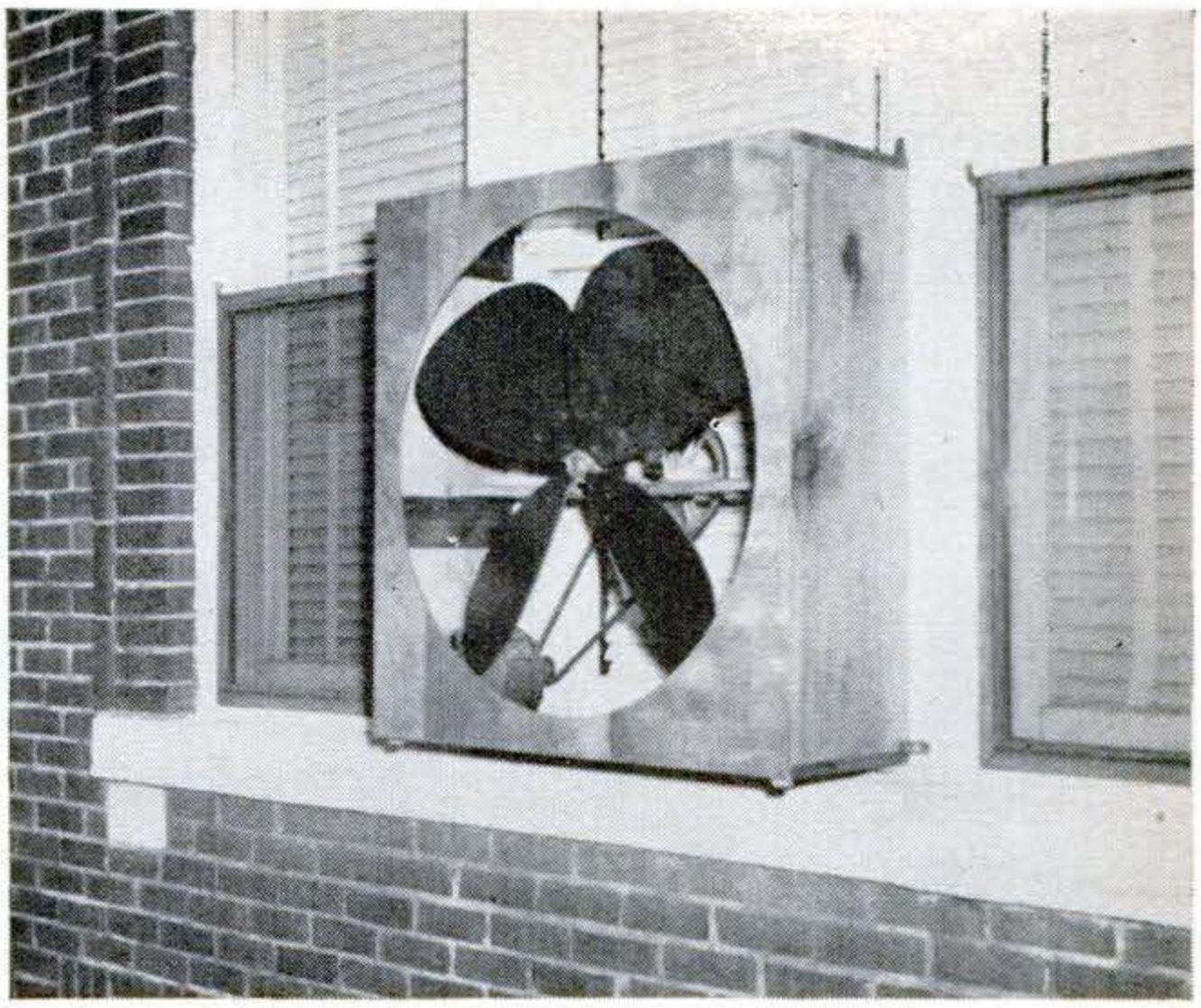
Keep Cool

This Summer



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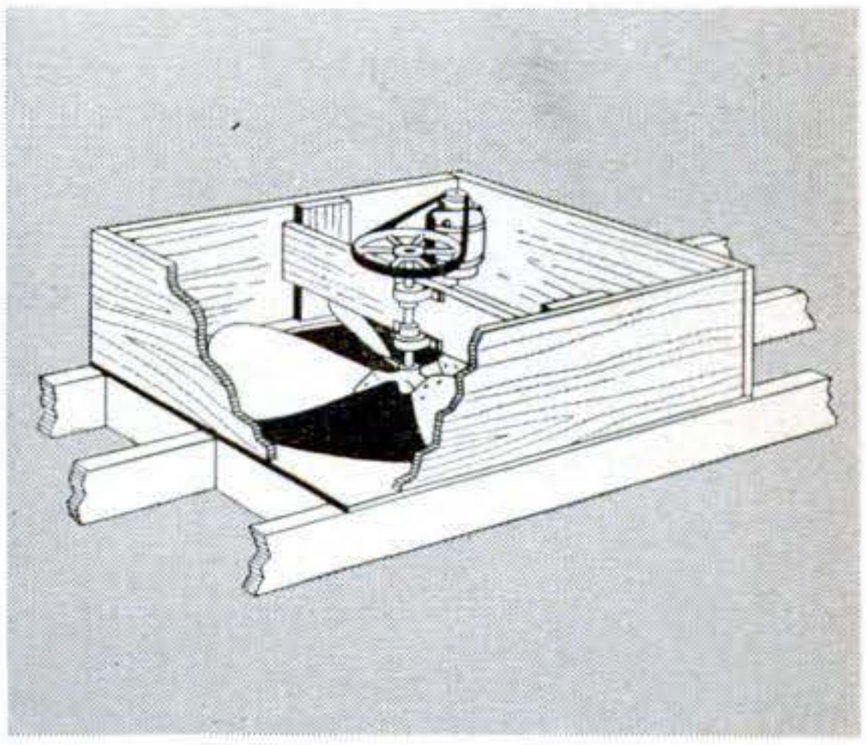

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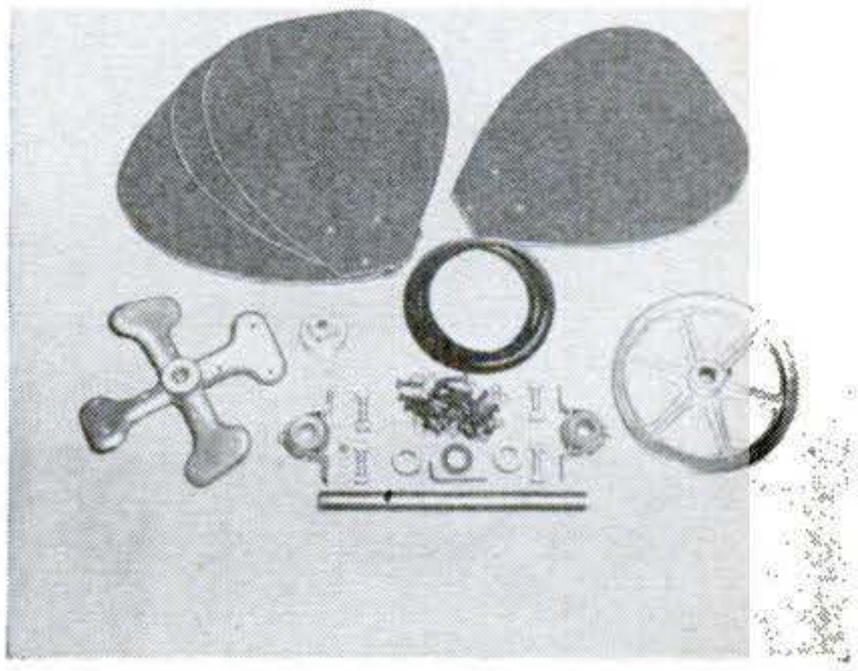

PARTS included in all kits: Aluminum fan spider, Masonite blades, shaft, oilite bronze bearings, collars, pulleys, belt and bolts. Everything you need with complete instructions.

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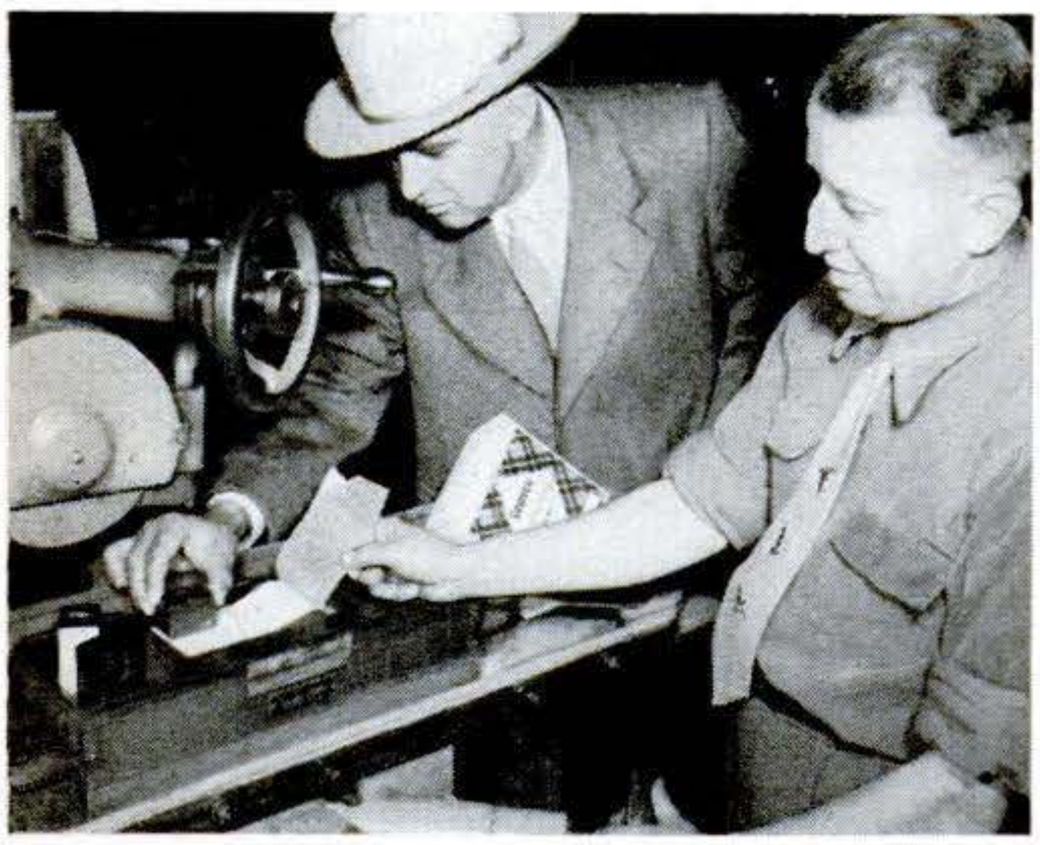
Thick Walls Fortify Army Lab

UNDER atomic blast, this massive steel-reinforced wall would roll with the punch. It separates the "expendable" office wing from the labs of the Armed Forces Institute of Pathology in Washington. The lab building is windowless, and three of its eight stories are underground. A tunnel connects it to Walter Reed Army Hospital.



Tape Bonds Castings to Chuck

INSTEAD of clamps, they're using pressure-sensitive tape now to hold nonmagnetic castings to magnetic chucks on grinding tables. One man above is pulling the paper liner from double-coated Scotch tape while his companion shows that the casting is solidly anchored for grinding.

He's America's No. 1 Sports-Car Driver

[Continued from page 238]

throttles incessantly, to keep the plugs from fouling, and from nervousness. The noise of all the unmuffled, high-performance engines becomes physically painful. Blue smoke swirls above the cars.

A green flag flashes, the din becomes unendurable, and the entire field takes off, accelerating savagely and jostling as the cars sweep into the first turn. They disappear in a haze of dust and smoke, engines shrilling and rubber sliding. Kimberly had started in the third row, with seven cars ahead; he was third going into the melee; now he emerges leading down the long back straight. Two other Ferraris are dogging him.

The faster cars go arrowing down the straight, accelerating as though from catapults, while a great batch of slower cars are still moiling in the first turn. On the bridge the timing girl settles down to the charts and stop watches.

Thinning out. Mechanical troubles begin to cut down cars—faded brakes, slipping clutches, engines gone "blubbery" at high revs. One car flips viciously, ending inverted in a cloud of dust, but its unhurt driver is soon joking in the pits. Several spin out with sickening rubber shrieks; most of these give up, but a few race off, trying to regain the time lost.

Watching near one turn, you can see that each of the leading five drivers is constantly close to "losing it." Cars are pushed so near to the thin edge of controllability that they seem to be traveling on ice. Kimberly, competing savagely with two Ferraris, spins and loses 38 seconds before he regains speed. Now five cars lead him. Going even faster, he fights back past three when the race is finished. The two cars ahead are 4.5s.

In the pits, the engine muted, he sits in the car for a few minutes, unwinding. Marsh hands him a cup of water. "Pretty good going," you say.

He stares back at you, track grime on his face underlining the fatigue of almost two hours of thin-edge driving. "Not good enough," he says. "But there are plenty more races coming." END

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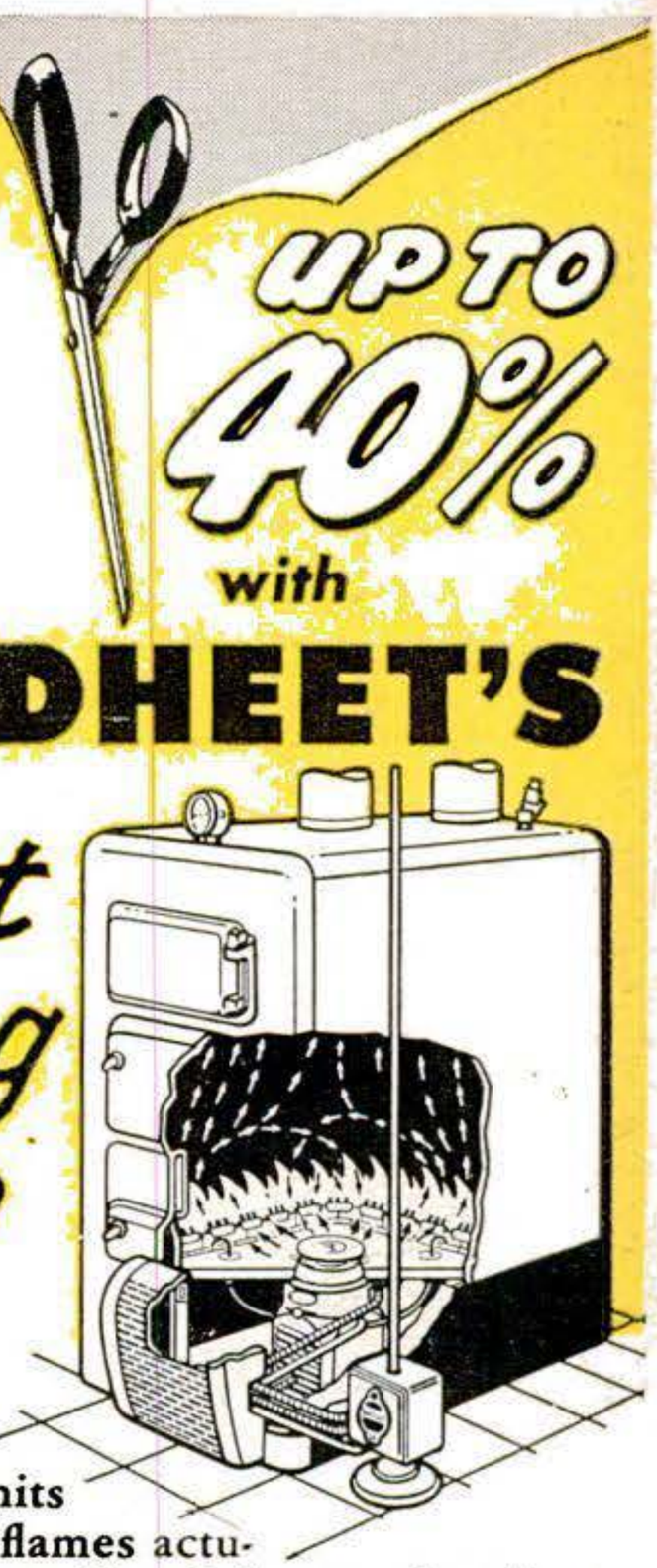

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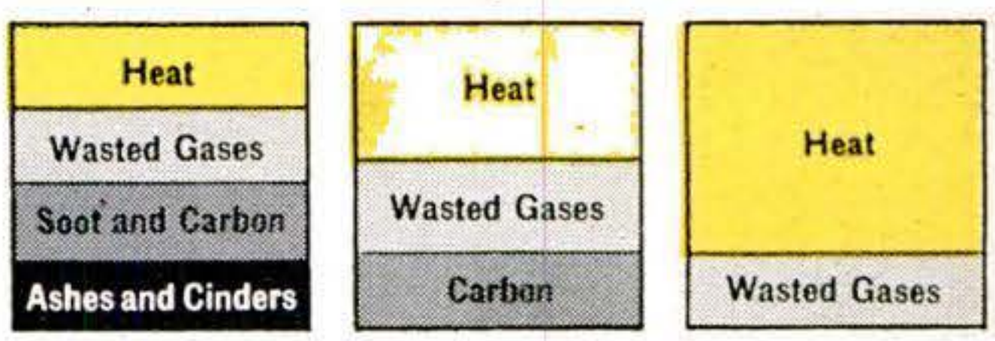

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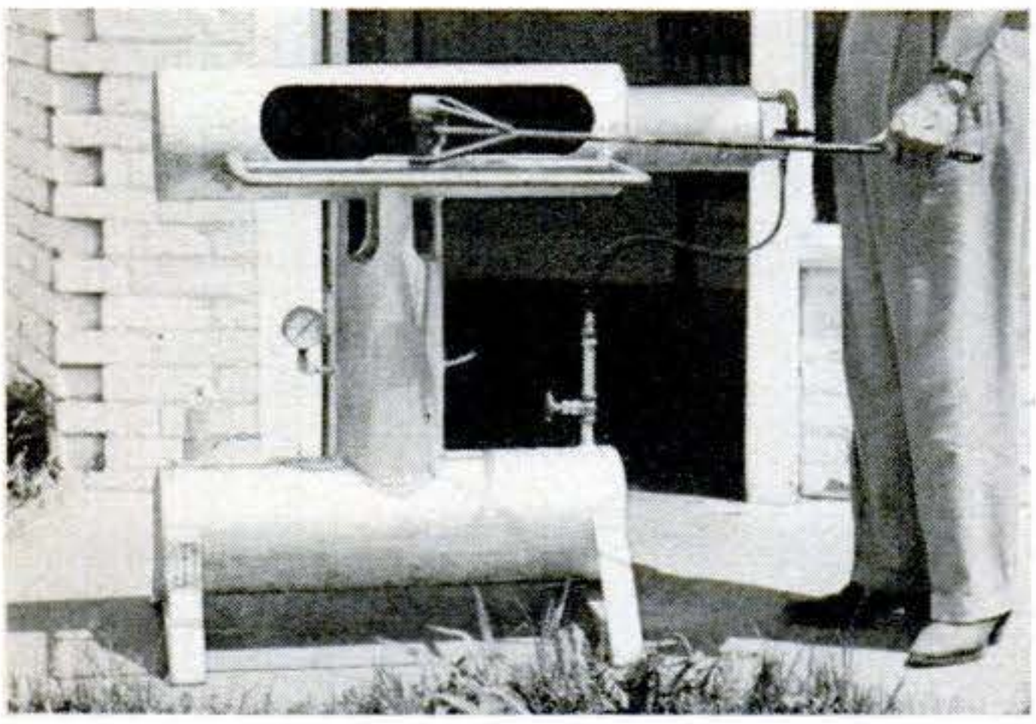
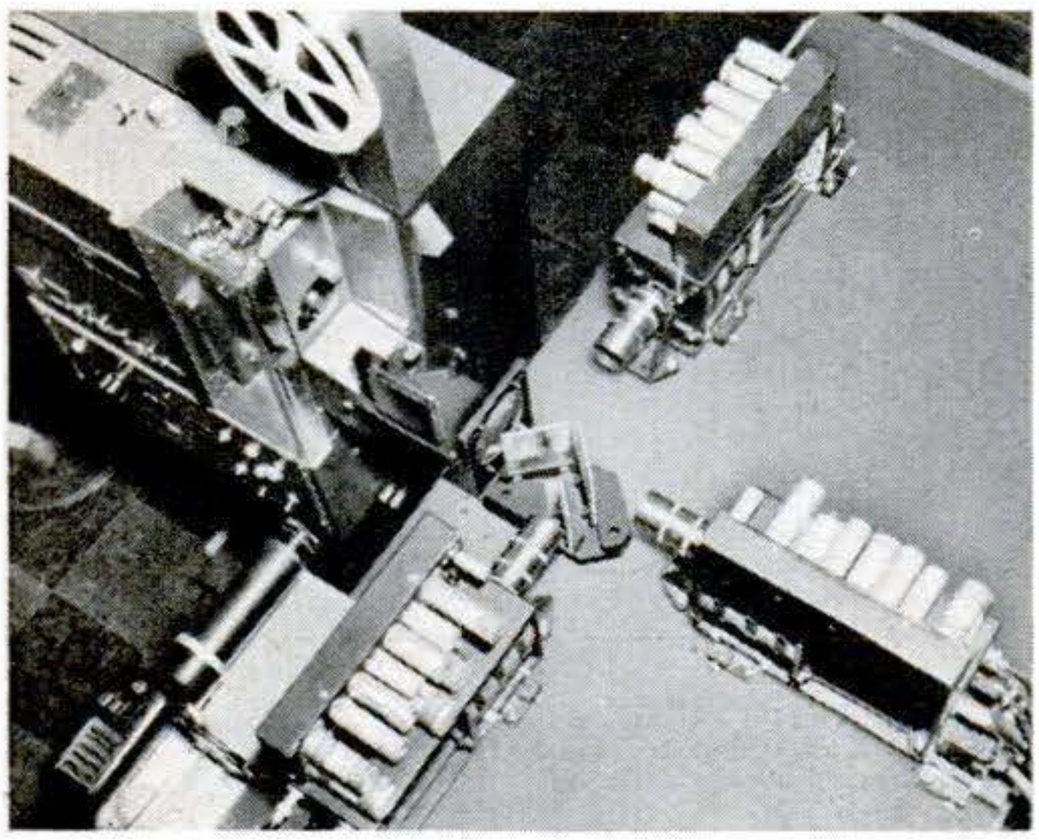
Lab Rat Gets Its Teeth Brushed

RADIOACTIVE toothpaste costing several thousand dollars a tube was used to clean the teeth of this rat. Periodic checks with a Geiger counter then told Colgate-Palmolive researchers how long a new anti-decay ingredient stayed on the rat's teeth.



Burner Finds Home on Range

COWPOKES no longer need to build fires on the range to brand calves. A few puffs from a tire pump and the oil-burning furnace above is ready to heat several irons red hot at once. The Conners Welding Co., Ponca City, Okla., makes it.



Radio Rolls Out This Barrel

WHEN Allan Tamplin of Birdham, West Sussex, England, says he'll "roll out the barrel," that's what he means. Seated on the lawn or in a distant field, with radio controls, he pushes levers and a beer keg rolls out of his house, swerves to left or right as necessary and comes to rest at his feet. An inner container prevents the brew from being shaken as the barrel rolls.

New Rig Televises Color Movies

MIRRORS split an image into blue, green and red portions and a separate tube picks up each color in RCA's new system for televising movies in color. The two dichroic mirrors are angled in front of the projector with the three pickup tubes around them.

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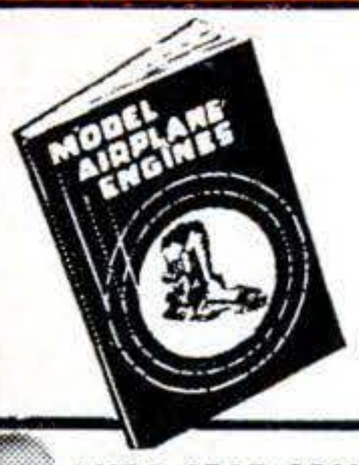

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	Fuelmix (sent by Express Collect. No C.O.D.)	$1.00	$ . . . . .
	ADD TOTAL		
	Flywheel (boat or car)	75¢	$ . . . . .
	Tank	50¢	$ . . . . .
	Spinner	75¢	$ . . . . .
	Control Wire	75¢	$ . . . . .
	Control Handle	$1.00	$ . . . . .
	Electric Motor	$1.95	$ . . . . .
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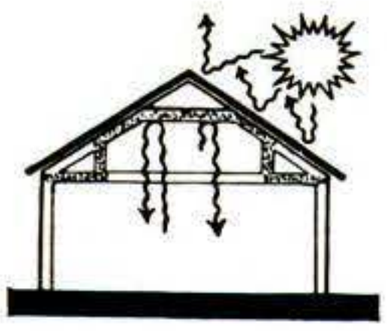

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Smoke-Eating "Cats" Attack Smog

[*Continued from page 85*]

the courts to shut down Enamelstrip until it stopped pumping "penetrating, disagreeable and noxious" fumes into the air. Like many other industries, it had tried to curb smoke. But nothing would kill the fumes from its bake ovens.

"I read about your lift-truck work," said Uhleen. "Wouldn't the same idea work for us—in our stacks?"

Eagerly, Houdry tackled the new challenge. A few weeks later he put 918 Oxycat units (60,000 cat rods) inside Enamelstrip's fuming stacks. The smells all but vanished—a judge even climbed to the roof to see for himself.

Moreover, the cats had stirred up such

> ***A fellow with a chip on his shoulder is most likely to get splintered.***
>
> —THE SIDEWALK SUPERINTENDENT

a turmoil in the stacks that intense heat was generated. Engineers put in fans to suck the heat down to help heat the ovens. Enamelstrip's gas bill dropped from $3,000 to $300 a month.

Cars are another matter. Those cats that sweeten the breath from smokestacks and fork-lift tailpipes won't quite work on your car's exhaust. Most of today's automobile gasoline contains lead, added to boost the octane rating. And lead poisons the cats.

But now Houdry has a cat that he says will work with either "white" or leaded gas. That new one is what's in the mufflers of those six cars in Texas.

Houdry's cats may also come into your home. They may not do much for your present oil burner. But Houdry thinks a new burner, designed to work with cats, could run without fumes—on less oil.

Houdry engineers are at work, too, on a catalytic incinerator. In it your wife could burn trash and garbage to fine ash in a small kitchen unit, without odors.

And then there's the air purifier. Before guests came you would push a button, and smells from the corned beef and cabbage would all burn up. END

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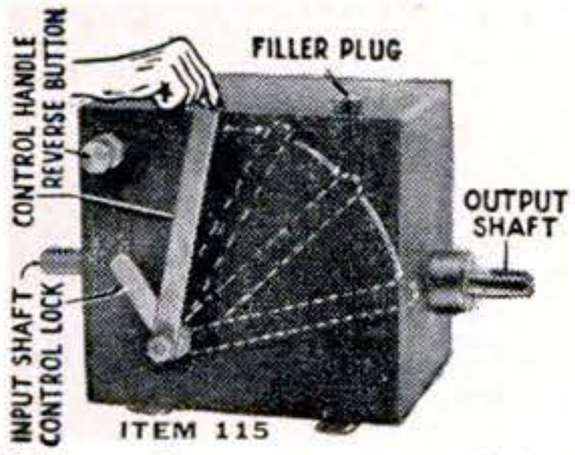

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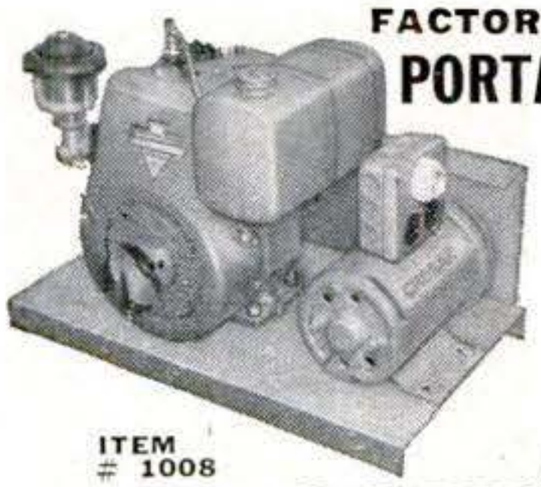

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Total head-feet	Speed	H.P.	GPM
25	3600 RPM	3	180
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20	2400 RPM	½	75

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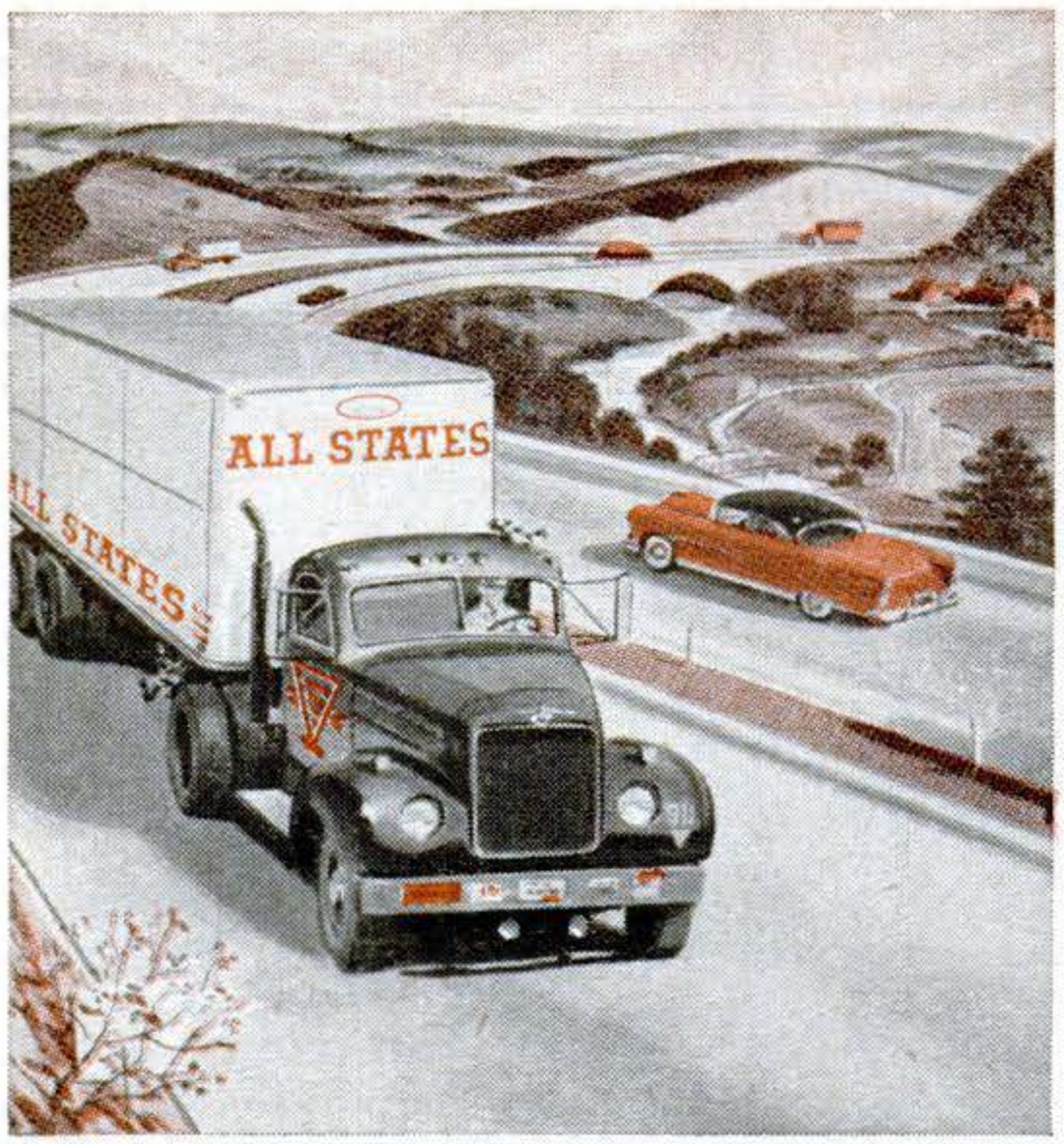

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How You Become an Atom Bomber

[Continued from page 106]

"Checked."

Morgan and Strank learned that the B-47 had been built to "fail safe."

"Your power boosts on your ailerons fail," Willis droned on in his flat and inexplicably incisive tone, "it's no sweat."

First, an electrical emergency pump automatically takes over the duties of the ailing mechanical pump that normally taps the engine for power to produce hydraulic pressure. If *that* fails, another of the six jet engines automatically intervenes to supply pressure.

By the time Major Morgan and Lt. Strank were ready for solo, two flights away from graduation, they had begun to feel at home in the B-47.

> ***All you have to do to get an American to invent something is to tell him the Russians haven't done it yet.***
> —THE SIDEWALK SUPERINTENDENT

"Lightfoot Control," Morgan radioed as his bomber reached for altitude in its climb-out after take-off. The term identified him as the pilot of a B-47. Jet fighters based at McConnell are under Hopalong Control. "One zero four," he said, "off McConnell at zero eight one seven, flight plan received as filed, climbing on course."

Above him and his co-pilot arched the sky, a robin's-egg blue near the horizon, cobalt at its zenith. Below was the boundless patchwork quilt of Kansas farmlands. And all about, like a sea engulfing their swift, swept-wing mount, was the splendor of the loneliness that only a flier knows.

On the ground, Charles Edwin Willis, captain, USAF, watched the alabaster contrails of his soloing students as they pierced the eight-mile mark in the stratosphere.

"Sort of," said Willis, gingerly skirting any emotion in his tone, "sort of makes a man feel good."

It ought to make millions of other Americans feel good, too. END

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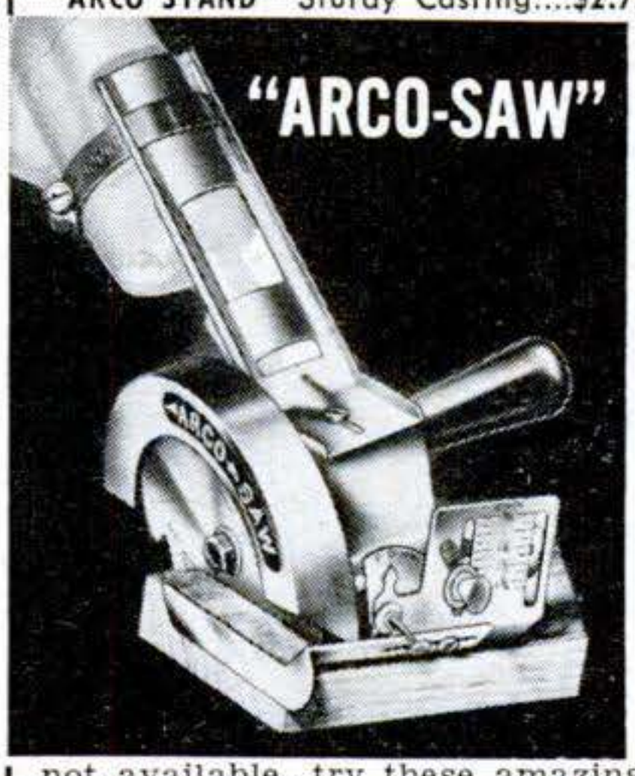

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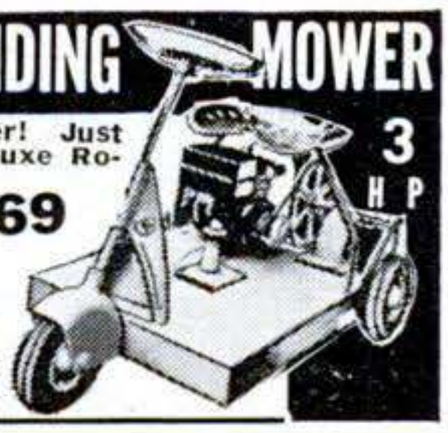

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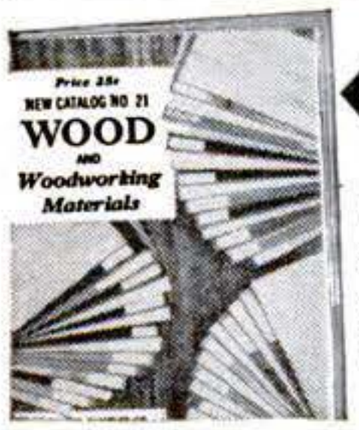

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Electronic Eyes for the Blind

[*Continued from page 114*]

matches to light his pipe. His narrow, businesslike office, with equipment-loaded counters along the walls, is on the third floor of a wartime wooden barracks, a long walk behind MIT's fancy Charles River facade.

"I'm not one of those electronic engineers who's ashamed to use moving parts," he says. "I set out to make an effective curb locator and that's what we have. It turns out to be quite easy to add an obstacle detector to it."

The curb locator has a tiny incandescent lamp vibrated by an arrangement like a doorbell armature. This gives a spot of light that travels back and forth across the ground between six and nine feet ahead. A few inches above the lamp is a photocell sharply focused on a small narrow rectangle of ground seven feet ahead.

On level ground, the receiver sees the light spot at regular intervals as it sweeps across. This generates a steady signal that does *not* operate the alarm. At a curb, the receiver looks over the edge and misses the light spot, interrupting the signal. That triggers a probe in the handle which vibrates against the palm of the blind person's hand.

The first model worked fine—in good weather. Rain caused false alarms. "I soon realized," explains Witcher, "that this was because the water on the surface of the ground acted almost like a mirror, causing most of the light from the device to be reflected up and away, and leaving almost none to be scattered back to the receiver.

"The answer was more light and a better optical system. The new detector is able to receive a signal from the worst possible type of mud puddle—one with a very dirty black bottom." He demonstrates in the laboratory with a black-paper-lined dishpan full of water.

For obstacle detection, a prism deflects some light straight ahead. An obstacle would bounce this beam back to a second receiver mounted just under

[*Continued on page 250*]

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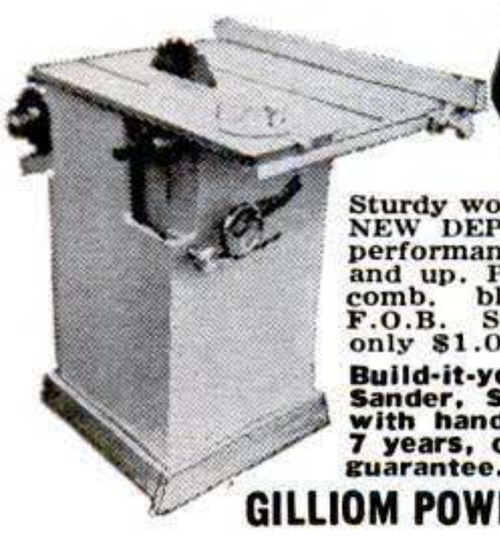

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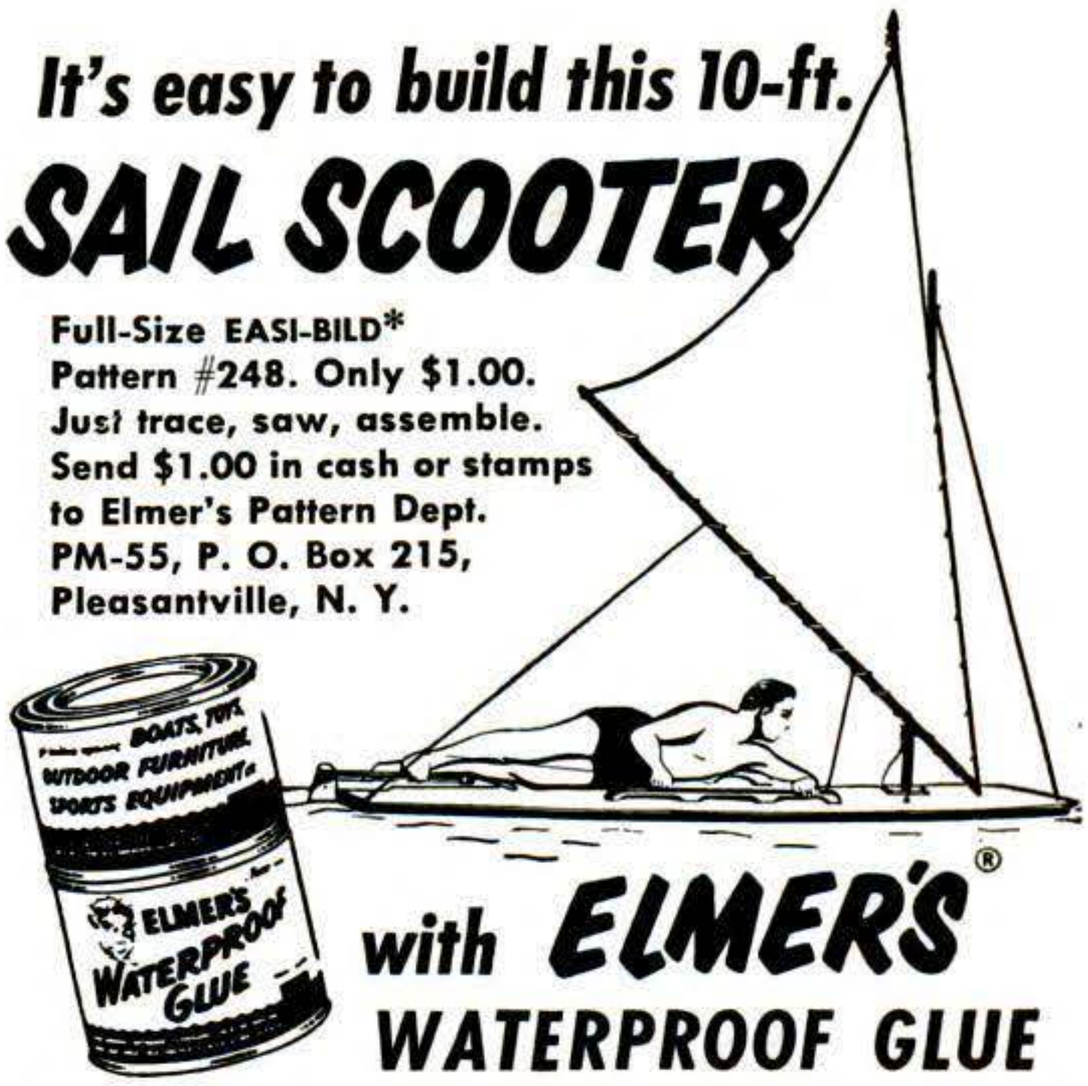

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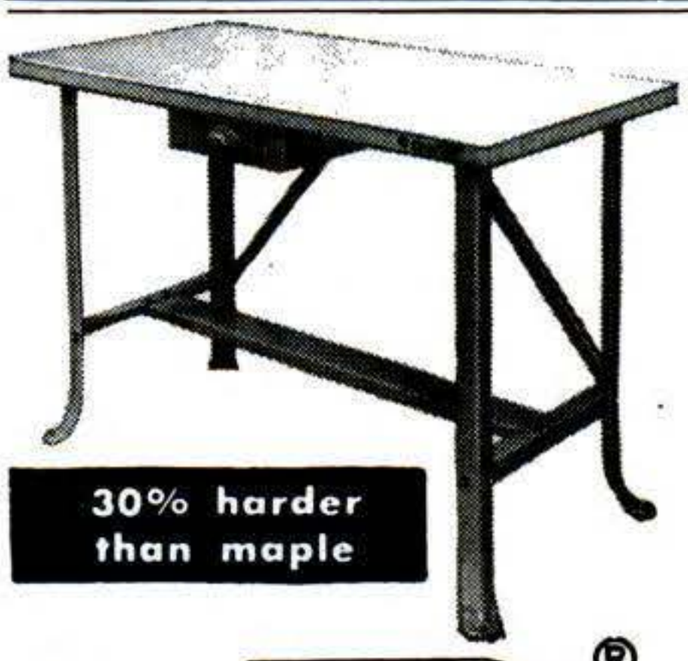

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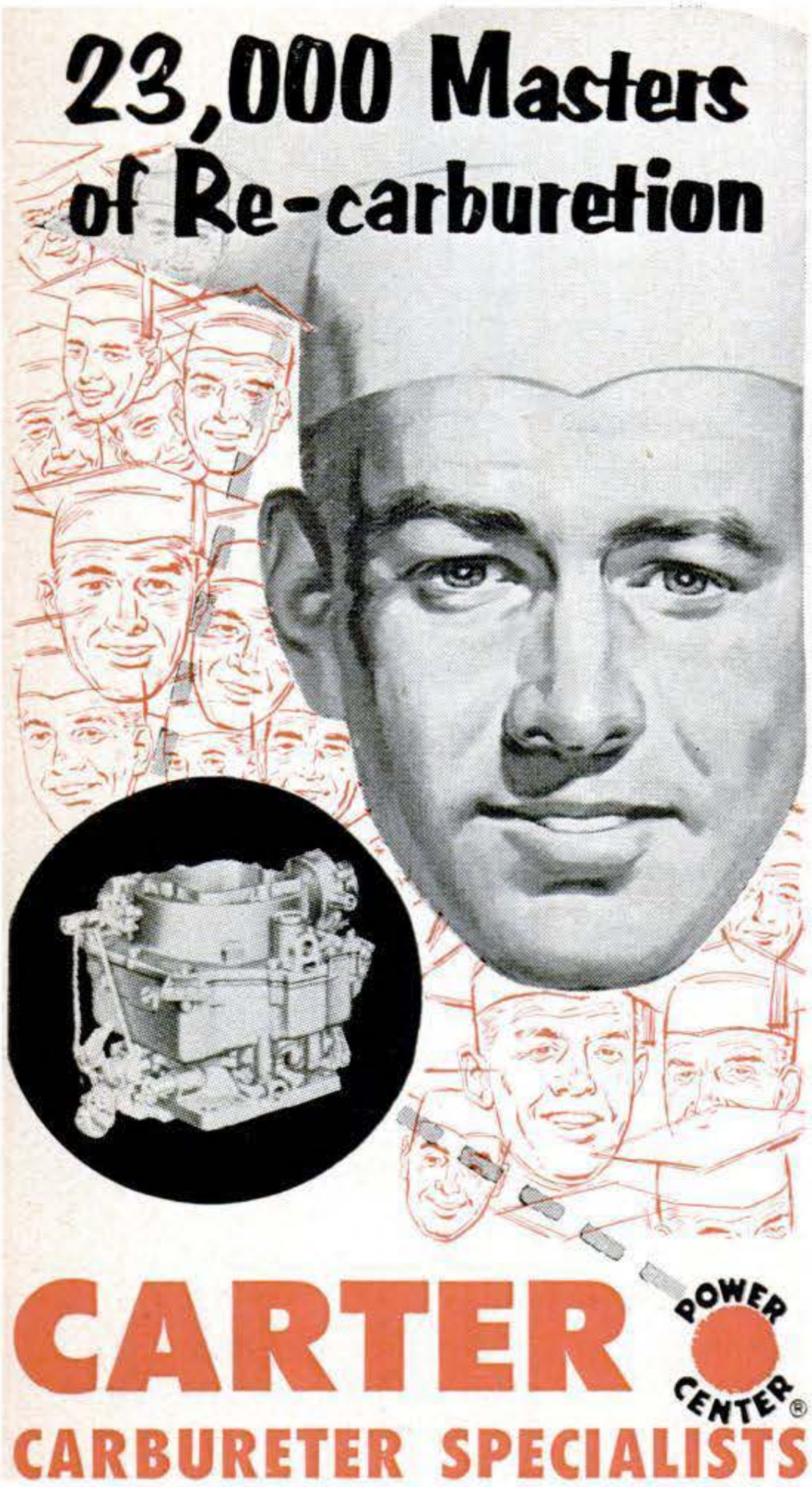

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Electronic Eyes for the Blind

[Continued from page 248]

the curb receiver. The signals feed finger probes, as in Benham's device, but with a difference.

Witcher explains: "The probes for the four fingers correspond to different directions, and the length of time that each probe pokes the finger tells how far away the obstacle is—a short poke for the most distant obstacles, eight to 10 feet, and a longer poke for closer obstacles. The curbs are signaled by a firm poke in the palm of the hand."

Witcher has built in automatic scanning to eliminate the chore of oscillating the device. A small solenoid oscillates the whole front end—light and two receivers—through a 60-degree angle.

Both Benham and Witcher have gone to great lengths to make their guidance devices inconspicuous. Benham's will look like a book—a box about nine inches by six by three. His xenon light gives off only infrared rays, so the beam will be no more visible to sighted people than it will be to the blind man using it.

Witcher plans to conceal his device inside a brief case and expects to have enough room left over so that it can actually be used to carry papers. His incandescent lamp gives off some visible light, but this will be blocked by a black shield over the front so that only invisible infrared gets out.

When can a blind man expect to get one of these magic eyes? Witcher should have a complete instrument ready for testing this fall or winter. Benham, who has just started on his curb locator, will require a little more time. Both estimate two or three years, at the very least, before production models can be ready. As Benham remarks, "Unusually good fortune would shorten the time, but we dare not pin our hopes to fortune. Let us do all we can to make it no longer." END

Thousand to One

It takes more than 1,000 nuts to hold an automobile together, but only one to scatter it over a highway.—*T & P Topics.*

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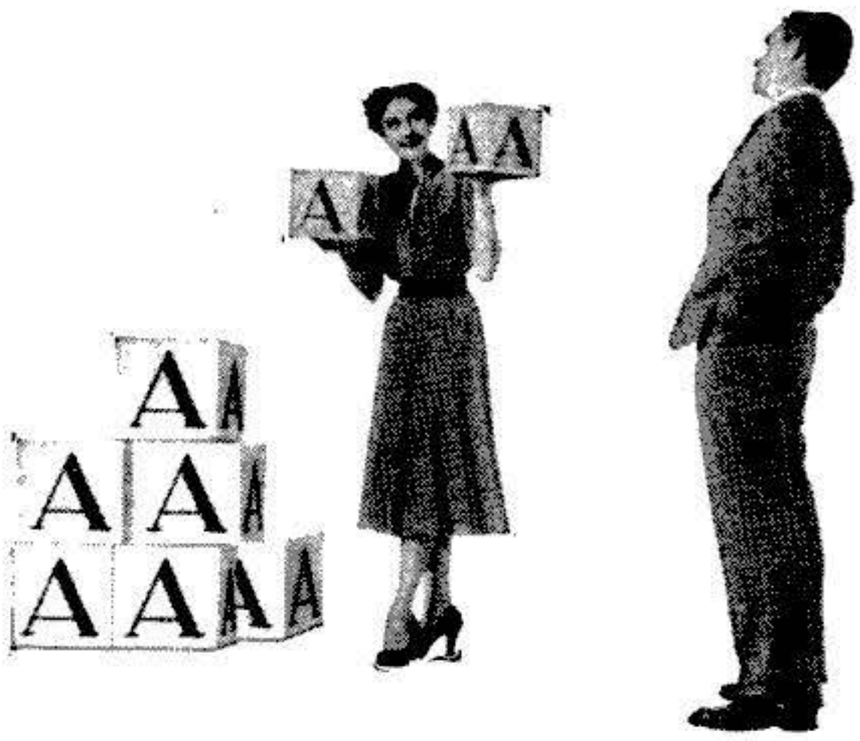

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WANT UNIFORMITY? PATRONIZE THE DEALER WHO PROVIDES YOUR FAVORITE BRANDS

He'd Like to See 'Em Make Safer Cars

[*Continued from page 130*]

man strapped to a seat and subjected to rapid deceleration would suffer a horrible death. His eyes would pop, they thought, his muscles would tear, and his bones would snap. Actually the human body is so tough that it will survive powerful forces of deceleration—so long as it doesn't hit something hard.

Some other devices, recommended in airplanes or in automobile racing, could be used in passenger cars too, but I do not intend to be unrealistic. For instance, a seating arrangement in which everybody faces backwards is useful in planes, but I doubt that automobile passengers would accept the idea. And I don't think crash helmets will ever find much favor.

It will be difficult enough to persuade automobile passengers to use safety belts, even if it is pointed out that on long trips these belts prevent fatigue. But drivers have learned a few elementary rules. They have learned to dim their lights. They are beginning to understand the survival value of courtesy on the road. They may yet learn the value of safety belts.

To provide these belts—and many of the other safety features—is, in my opinion, one of the first obligations of automobile manufacturers toward the people who are buying their cars. The causes of injuries are becoming known. Eventually, I believe, the lion's share of the automobile market will not belong to the company that builds the shiniest or fastest or most luxurious cars. It will belong to the company that builds the car in which you can survive an accident that would once have been fatal. END

Spelling It Out

A tourist spotted an Indian sending up smoke signals in the desert. He had a fire extinguisher strapped to his side.

"What's the idea of the fire extinguisher?" asked the tourist.

The rugged redskin replied, "If me misspellum word, me erasum."—*Viking Vacuum.*

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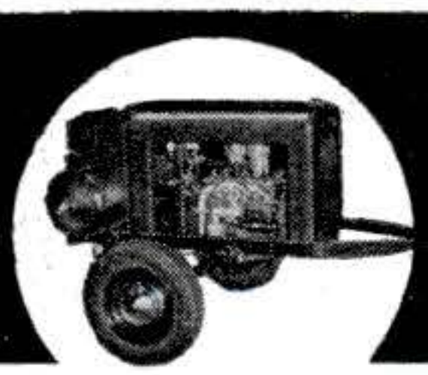

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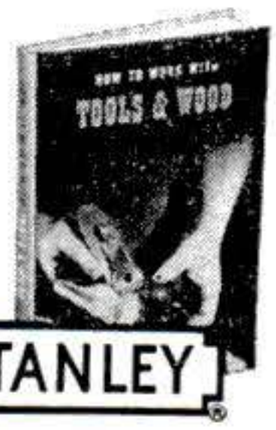

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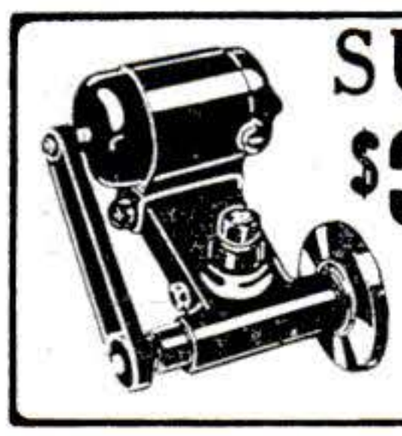

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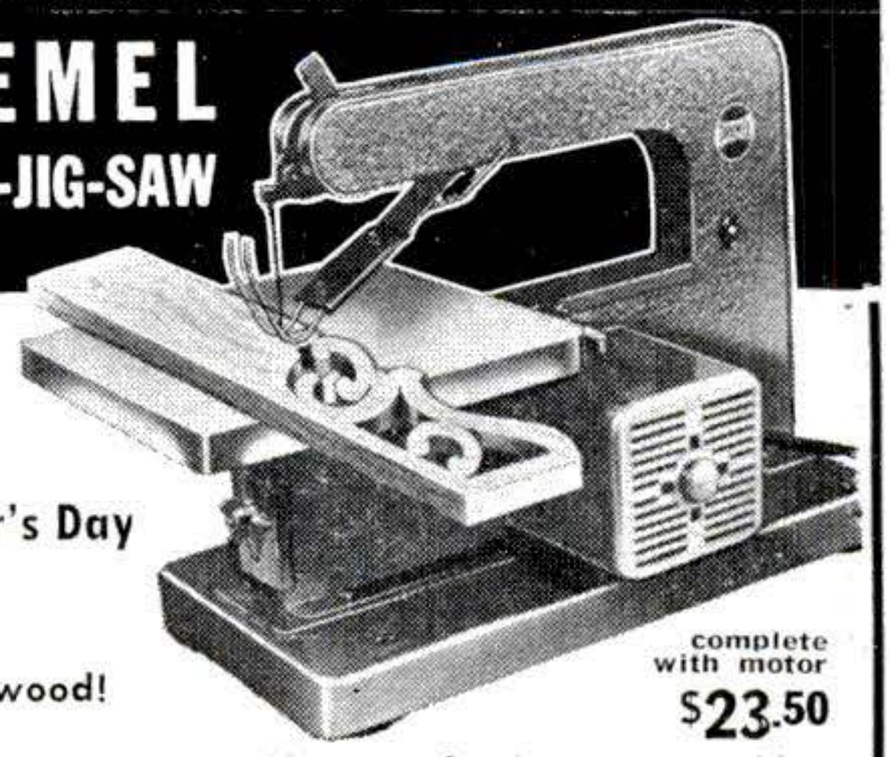

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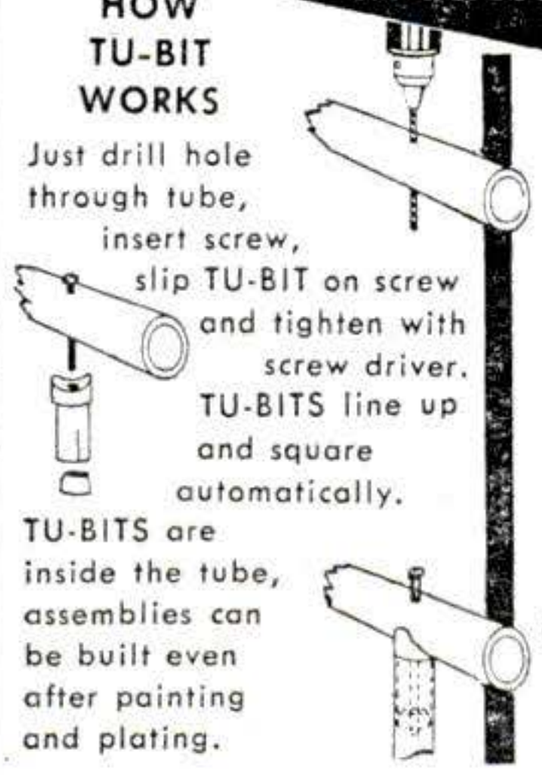

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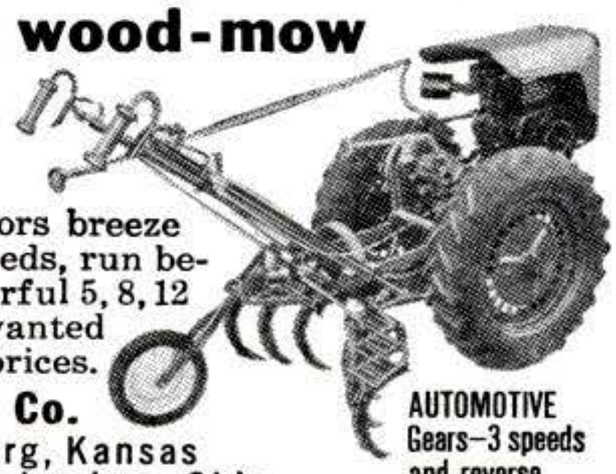

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[*Continued from page 139*]

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That's why an air-conditioning solar-heat combination looks so hopeful. This is particularly true in the wide areas where air conditioning is increasingly demanded in summer, and only a moderate amount of heat is needed in winter. There are several ways such a combination might be worked out.

• The solar water tank might be used to store cold water in summer. This large reservoir would enable a house to be cooled with a smaller—and cheaper—air conditioner which would run at off hours, storing up cold water.

• Air conditioners with built-in electric heaters, already on the market, might be used to boost the solar-heating plant.

• Heat pumps, which can warm or cool a house, might be given a wintertime boost with a solar collector.

• The solar-heating plant itself might do both jobs. This would mean reversing the system so that hot air from the rooms would be pumped to the heat storage area and cooled before being returned to the room. The stored heat would then be expelled directly to the open air at night. Dr. Telkes actually did this.

Dr. George Löf has done considerable research on the same idea for the American Window Glass Company. He has designed a house for the Dallas area using this reversible system and storing the heat in bins filled with rocks. END

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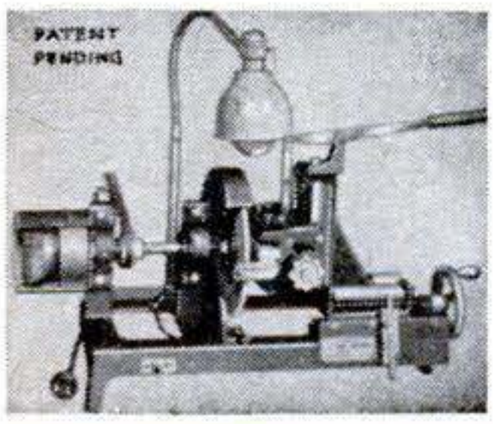

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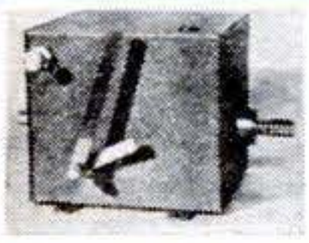

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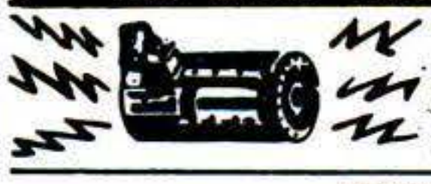

P1 GENERATORS
Electric, Auto-Lite, 200 Amps, 24 Volt, 4400 RPM, Dandy arc welder. Wt. 53 lbs. Approx. GOVT cost $450. Like NEW. **$12.50** incl. easy diagram.

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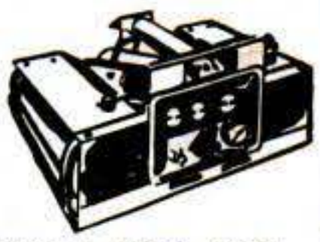
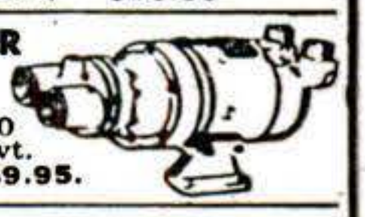


Terrific for hunters, ranch, home, farm, civilian defense, boat, camp, trailer, barbecue, etc. Burns any type gasoline. Burner 10¾" dia. Unit approx. 23" x 21" x 10". Has 2 tanks (21¼" x 5⅜") with welded seams, 3 brass valves, 3 air filters, air gauge to 80 lbs. Can use as air tank for compressor or fill with liquid for spraying. NEW Korean war surplus. Wt. 95 lbs., boxed. Approx. GOVT cost $150. Complete with 2 spare energizers and orifice cleaner (compare this price) — **$10.50**

NEW PUMP AND MOTOR



Pump has 1" connections, built-in relief valve, adjustable up to 1500 lbs. Max capacity 6 GPM. 1½ H.P., 24-volt motor. 4000 RPM. Can be used on 12 or 36 volts. Govt. cost approx. $350 — our price — NEW — **$9.95.**

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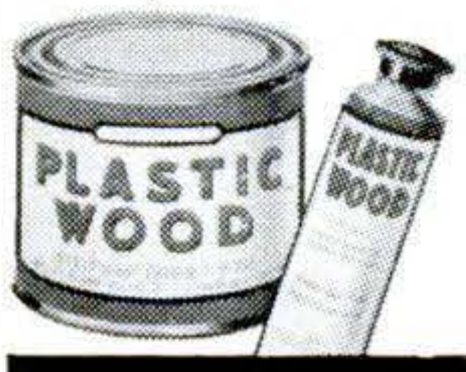

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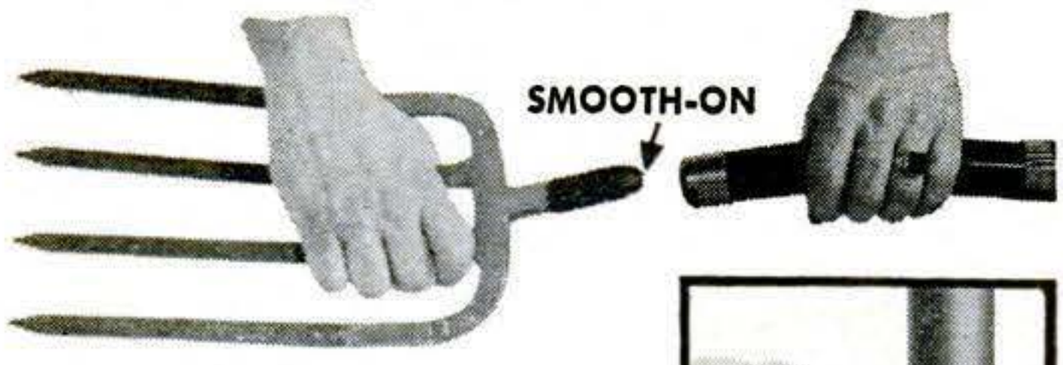

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"Fingerprinting" Molecules

[Continued from page 144]

an aerosol spray used to dry the hair after shampooing revealed that it contained carbon tetrachloride (a cleaning fluid) which damages the liver when absorbed by the skin or inhaled. That product was also withdrawn. Likewise a jar of "horse radish" brought in for analysis turned out to be grated parsnips, chemically doctored to give it a horse-radish taste.

"We have never lost a case based on this machine's findings," said Dr. G. Robert Clark of the Food and Drug Administration Laboratory. "We can usually identify materials 10 times as fast as by other methods, and do jobs that would be impossible otherwise."

A number of laboratory models of the infrared spectrometer were built during the Thirties, and commercial production got under way during World War II. The leading manufacturer is the Perkin-Elmer Corporation of Norwalk, Conn. Approximately 1,600 machines, each costing about $13,000, are now in use in the United States.

When World War II broke out, Hitler is said to have turned down German scientists who wanted to build the instrument, on the ground that it would not help the war effort. In the United States, it became an important aid in the synthetic rubber "crash program" which kept vehicles rolling.

How a tire will wear depends largely on the structure of the molecule, and the fingerprints were a valuable guide. All the big oil companies now have infrared spectrometers in their research laboratories, for the power an engine gets from its fuel and the lubricating value of an oil depend on the nature of the molecule.

The first step toward producing a new plastic, synthetic fabric, antibiotic, insecticide or other organic chemical product is the construction of a new molecule by a chemist. But the chemist doesn't know what he has until he analyzes it. Once, he had to conduct many laborious and time-consuming tests be-

[Continued on page 258]

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A bullet sang through her sleeve

AFTER THE BATTLE of Spotsylvania, she wrote, "I have cooked ten dozen eggs, made cracker toast, blanc mange, arrowroot, washed hands and faces, put ice on hot heads, mustard on cold feet, written six soldiers' letters home, stood beside three death beds . . . It has been a long day . . ."

But no longer than the terrible day at Antietam, where as Blue and Gray fought to a bloody standstill, a bullet sang through her sleeve and killed the wounded soldier she was caring for.

Or Fredericksburg, where the dying lay frozen to the ground, and a shell fragment tore her clothing but could not frighten her from working while the battle raged.

It is not so surprising that after the war's end, this slender determined woman went on to found the American Red Cross, almost singlehanded. For Clara Barton had become an expert at meeting grim disaster.

Like Clara Barton, today's Americans still meet trouble with skill and resolution. For the qualities that made her great still live in the American people. And the simple fact that these people are the real guarantee standing behind our country's Savings Bonds tells you why Bonds rank high among the world's finest investments.

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Regular or Chrome-Faced

***TOUGH on oil-pumping • GENTLE on cylinder Walls**

"Fingerprinting" Molecules

[*Continued from page 256*]

fore he knew. Now, the infrared spectrometer quickly tells him what he has. In many fields, "secret formulas" have become impossible, for any firm equipped with the machine can quickly analyze a rival product.

Du Pont, American Cyanamid and other big chemical firms use scores of these instruments as watchdogs in their processing plants to control the quality of products. Every few minutes a sample of the chemical is analyzed to make sure that no change is taking place in the recipe.

Many new uses for the instruments are being discovered. A Chicago paint company found that a big patch of its paint was off-color and unsalable. Infrared analysis showed that the linseed oil used in the paint contained a trace of formaldehyde. The tanks in which the oil had been shipped had formerly been used for formaldehyde and had not been well scrubbed. Now the paint firm uses infrared to check samples of all shipments before accepting delivery.

A boy in a West Coast filling station drank some liquid from an open beverage bottle, and went into convulsions. The bottle contained an antifreeze of unknown ingredients, and the doctor needed a chemical analysis to prepare an antidote. A sample was rushed to the nearest spectrometer, was identified in 10 minutes, and the boy's life was saved.

The instrument is used in cancer hospitals to perform urinalyses which may afford early diagnosis. And it is used in the study of the possible relation between cigarettes and cancer.

One of the newest goals for the instrument is to trace illegal narcotics to their place of origin. Dr. James J. Manning, technical director of the New York City Police Laboratory, has found that there are differences in the composition of opiates from different parts of the world. With this device he may be able to pinpoint the countries the dope comes from, and thus get on the trail of the big operators. END

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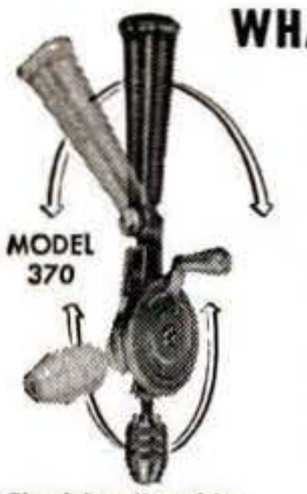

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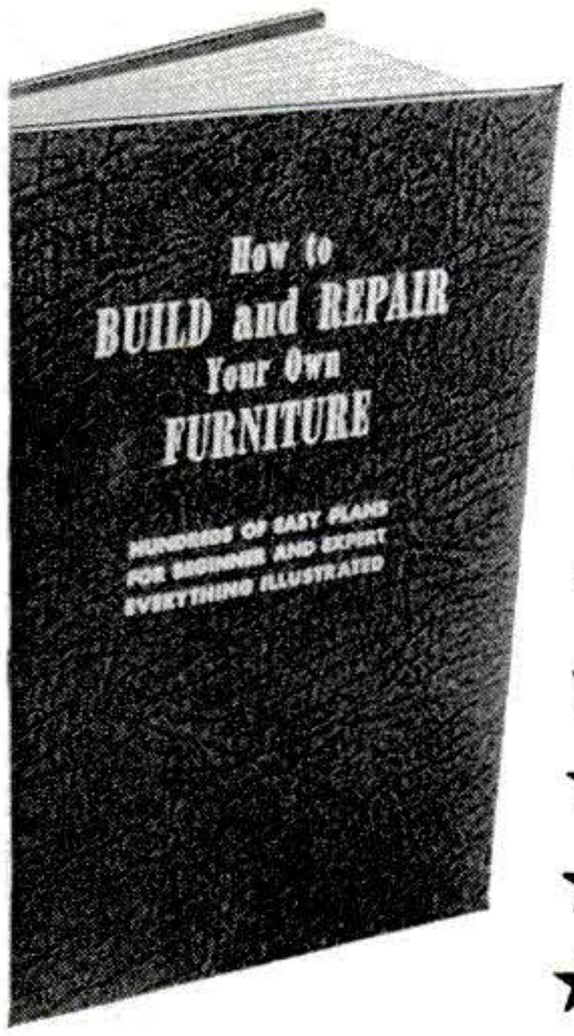

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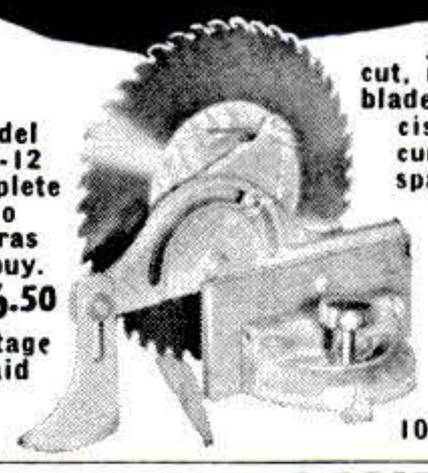

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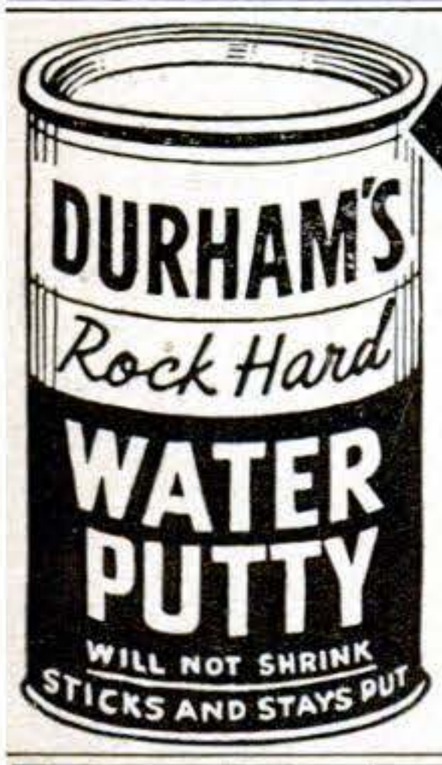

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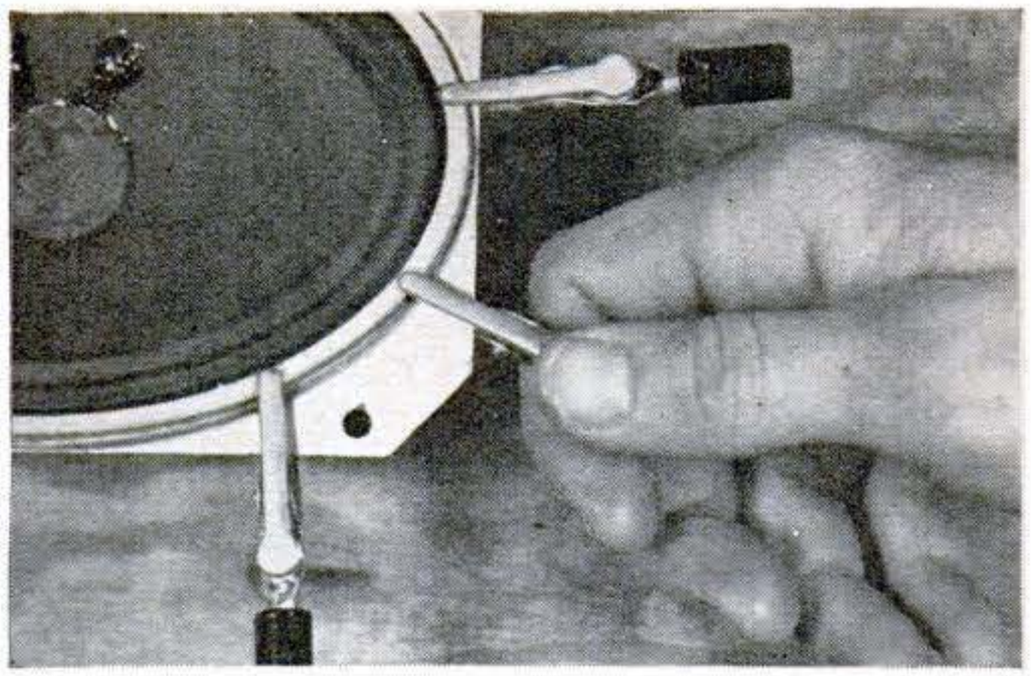

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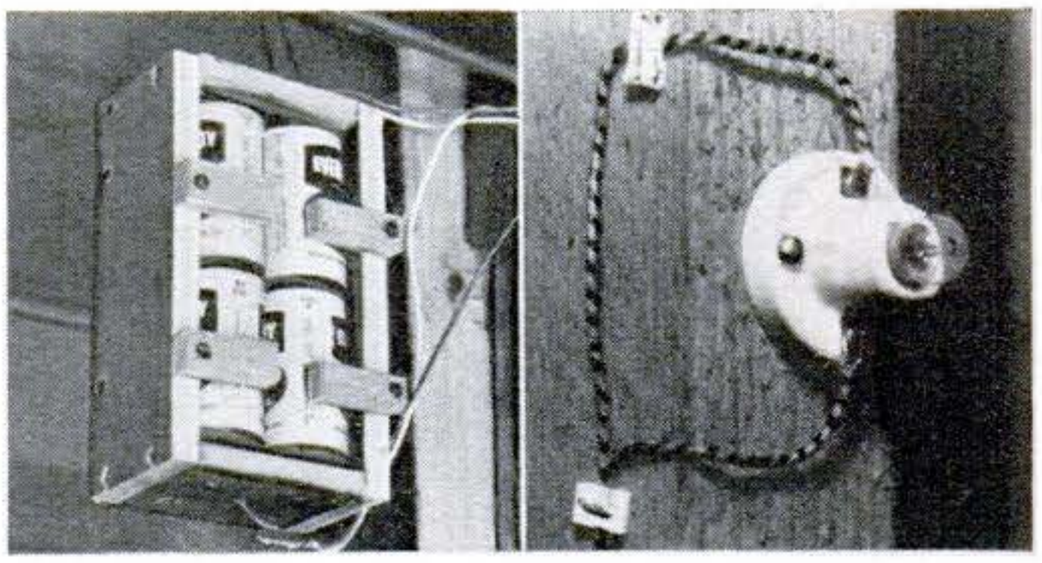
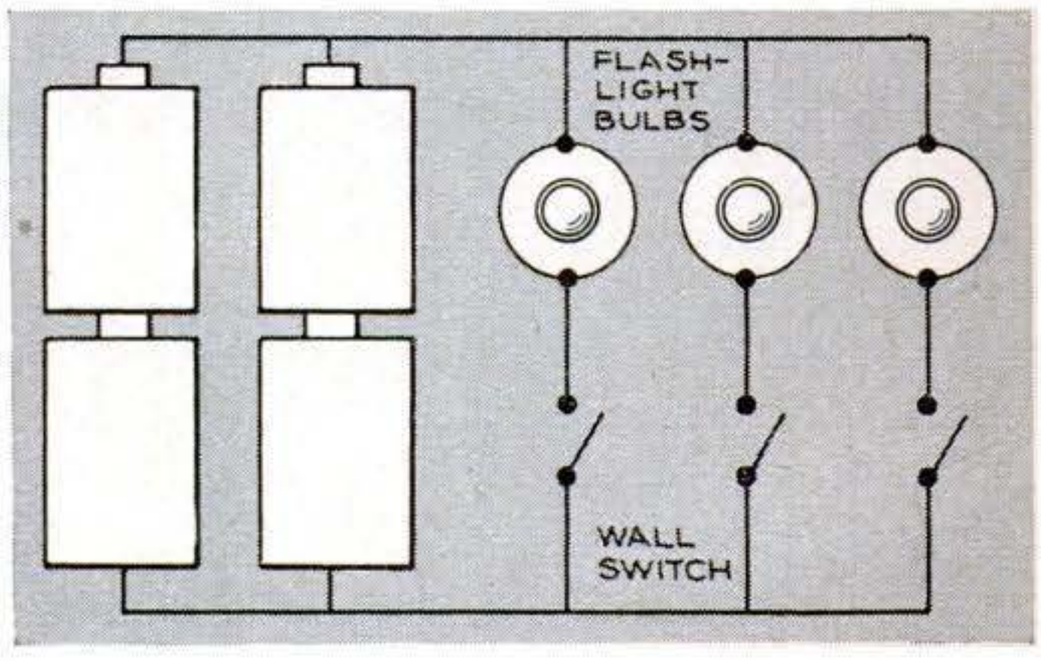


Batteries Light Summer Cabin

ORDINARY flashlight batteries will help light a summer cabin that isn't near a power line. Lamps and candles are still needed for main lighting, but the small electric lights will eliminate the danger of carrying an open flame from room to room. Mount 2.7-volt bulbs in small porcelain sockets and connect them with bell wire (above right). Four type-D batteries, wired in series-parallel (sketch below), will power several lamps.—*Willard Allphin, Danvers, Mass.*



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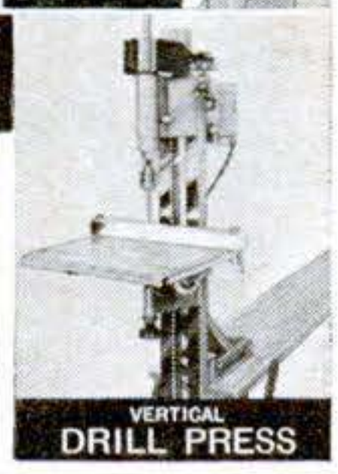

POWER TOOLS, INC. 272 YATES AVENUE, BELOIT, WISCONSIN

Biggest Bridge to Span Busiest Harbor

[Continued from page 93]

containing a ladder for a man to stand on so that the insides may be continually painted against rust and weather.

Once the towers are up, two long catwalks will be hung across the Narrows between them. The swaying walks will slope down from the tops of the towers (about 60 stories high) to the center, about 20 stories above the water.

Like everything else about the bridge, this sounds about a million percent simpler than it will be. First step in hanging the catwalks will be to lay cables across the harbor bed. Then all ships will be stopped (no easy task at the entrance to New York Harbor), as a crane atop each tower hoists up a cable (two hours for each, and there will be 72 cables altogether).

When cables are draped across the towers, one of the world's most spectacular aerial railways will go into operation. Catwalk carriages—electrically powered cars, with flanged wheels to grip some of the cables—will be hoisted onto these wind-blown rails. The carriages will carry men and sections of the catwalk out to midstream. The men will fasten the sections in place between cables. To fasten each section of catwalk will take half a day's work.

"Sometimes," says Mr. Decancq, "up there on those catwalks, hundreds of feet above the water, the wind blows so hard you don't know which way to lean."

There will be cleats on the catwalks, and rope rails, and the men will lean on the rope while they work, and hang onto it when the wind kicks up.

Above the catwalks, the wire that will form the bridge's four thick (perhaps 36½-inch) cables will be spun.

Galvanized wire, just like in your clothesline, is what the great cables are made of. The difference is there's more of it.

The wire will arrive on spools that hold 60 miles of it apiece. It will be carried across the water two strands at a time by spinning wheels that travel on

[Continued on page 268]

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G-1	160	30-used 12.95	New $19.50

Rheostat #27 or Carbon Pile Voltage Regulator. For regulating voltage & check pulsation on D.C. Generators. Heavy duty. Instructions **$6.95 ea.**

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FIRE EXTINGUISHER quart size brass finish, Good condition **#700FI $6.95** Postpaid **FIRE EXTINGUISHER & INSECTICIDE PUMP** 4 Gal. size approx. 3ft. hose & nozzle good cond. wt. 15 lbs. **$2.95** (add postage)

SENSATIONAL SELSYNS. Two or more connected together work on 110 V. A. C. For controlling distance, operation, etc. (Fig. 5). Instructions incl. **$9.95** per pair postpaid.

HYDRAULIC SOLENOID CONTROL VALVES. Bendix #81560. For remote control & hydraulic cylinders. For 24 V. D.C. & applicable for 110 V. A.C. Cap. 1500 P.S.I. $35.00 value. (Fig. 6). Instruction **$3.95** ea. **$7.50** per pair.

BEAM ROTATOR MOTOR #101. Reversible, Geared for TV, Ham, FM, etc. 2 R.P.M. For 110 V. A.C. or 24 V. D.C. Gov't cost over $200.00 (Fig. 7) Instructions **$9.95.**

SOLENOID #804. Gives ½" or 1¼" travel. Powerful for locks, switches, toys, etc. For 24 V.D.C. & applicable for 110 V. A.C. (Fig. 8). Instructions **$2.95** ea. **$4.95** per pair postpaid.

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CHANDLER EVANS LARGE WATER PUMP for oil, insecticides, etc. 400 G.P.H. ½" Drive spline shaft. 1" ports. (Fig. 2) **$7.50**

THOMPSON CENTRIFUGAL PUMP & MOTOR. For fuel, hot water heating circulator, etc. 300 G.P.H. For 24 V. D.C. & applicable for 110 V. A.C. (Fig. 3). Instructions **$7.50.**

BENDIX #548. For vacuum Air, fluid, pressure or as auto drain case pump, etc. 150 GPH, ⅜" ports. (Fig. 1). Instructions **$8.95.**

SPEED REDUCER. 5:1 or 10:1 ratio, 20 degree angle. Rated 2 H.P. **$6.45** ppd. RIGHT ANGLE DRIVE. 1:1 ratio through 90 degree bevel gears. Drive & take off shafts are ⅜" dia. Size 3½"x 2¾"x1½". (Fig. 4). **$3.50** Postpaid.

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ROMEC PUMP & MOTOR UNIT. Positive displacement. Rotary Type. 24 V. D.C. .28 H.P. 2500 R.P.M. 900 G.P.H. ¾" Ports. O. Cost over $150.00. New **$19.50.**

HYDRAULIC CONTROL VALVES. No. 21 FOUR WAY. Off at neutral, with built-in relief for limit of cylinder stroke & 3 positions. Raise, lower & hold. ½" ports. **$9.95.**

No. 227. FOUR WAY. Poppet type. 1500 P.S.I. ⅜" ports. 2 handle control. **$7.95.**

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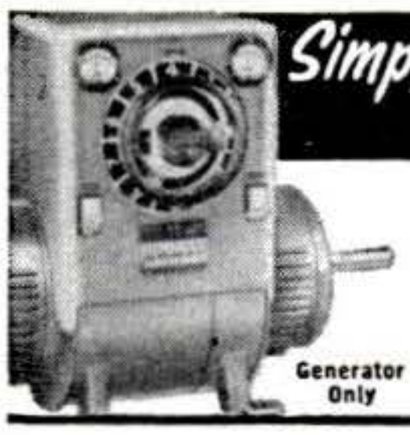

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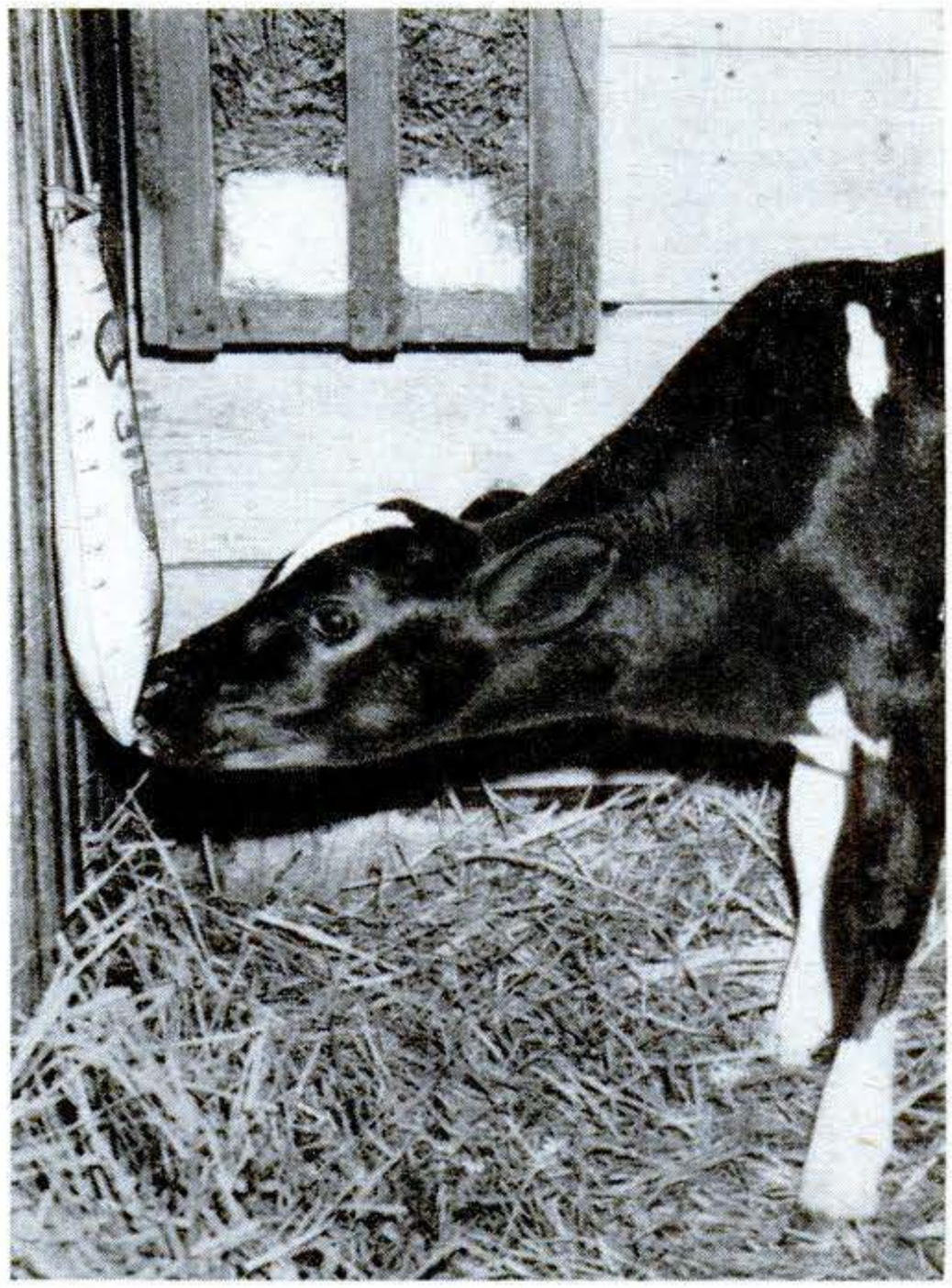
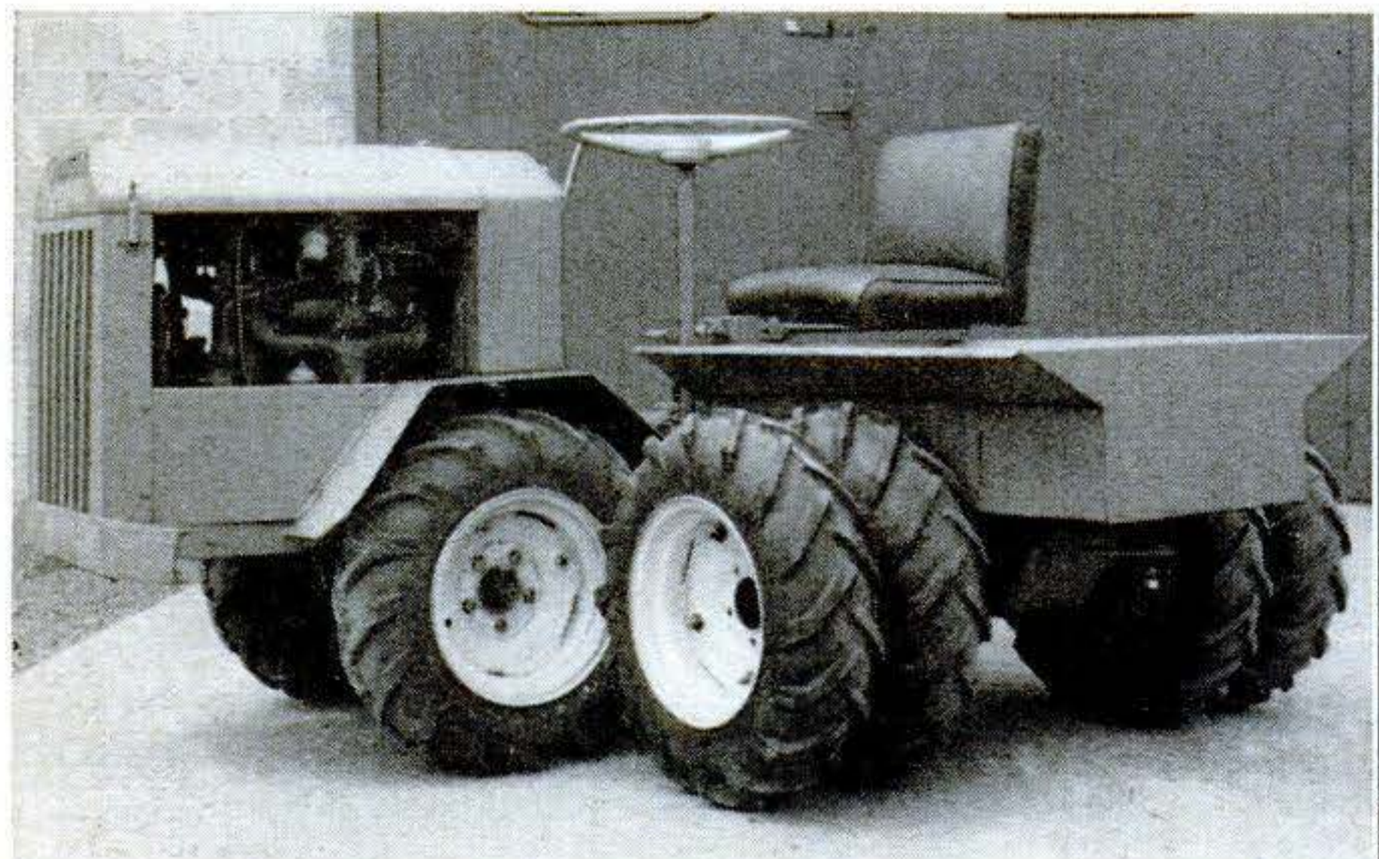
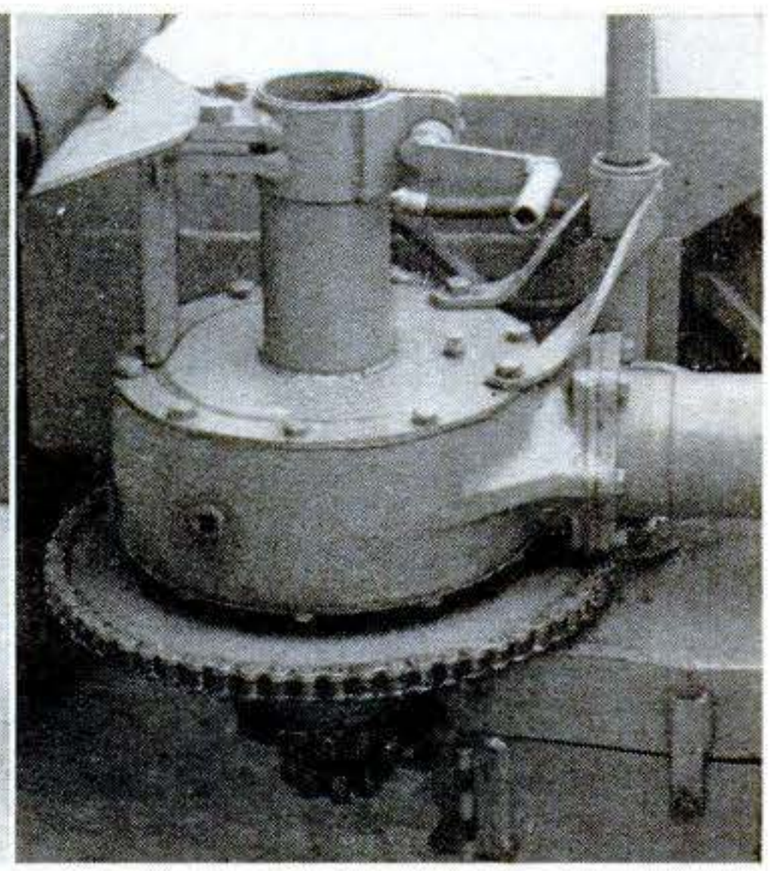
New on the Farm

More than a scaffold can be set up with these tubular frames. Erect an octagon, face it with snow fencing and you've got a stock pen or corn crib. Line it with waterproof paper, add an aluminum cap and it's a silo. Safway Steel Products, 6234 W. State St., Milwaukee 13, makes frames and cap.



Udder contentment is the lot of a calf fed at this nursing bag. Of soft plastic, it feels like the real thing to a young bossy and when emptied, it collapses like the udder so the calf can't suck air. The Nurs-A-Calf bag is put out by the McMillen Feed Mills, Fort Wayne, Ind.





You can turn on a dime with this tractor —the front and rear sections swivel on a turntable midway between axles. A 25-hp. Ford engine coupled to the swivel drives all the wheels, and conventional brakes and differential are omitted. The Tucker Sno-Cat Corp., Medford, Ore., also has a 100-hp. version with a Chrysler engine.

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SAVE 50% DO-IT-YOURSELF

Genuine Select PHILLIPINE MAHOGANY LUAN PLYWOOD

BUY DIRECT FROM IMPORTER

Ideal For Fine CABINET WORK, FURNITURE, Paneling DENS, OFFICES, HOTELS, etc.

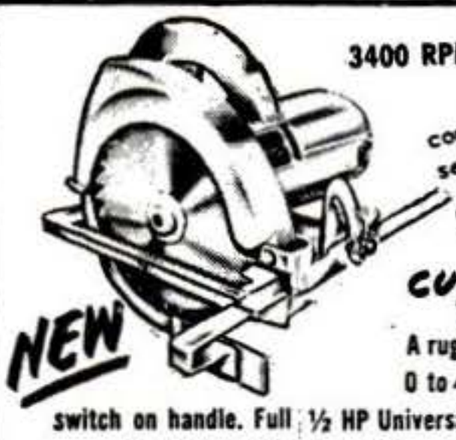
Our prices are LESS THAN DOMESTIC PLYWOOD at WHOLESALE. This selected LUAN MAHOGANY meets the most rigid specifications. It is WEATHER and WATER RESISTANT. You'll be amazed at the beauty of this fine wood. Its rich golden elegance will thrill you. Rotary cut for beauty of grain. Both sides sanded and ready to use. Bonded with finest resin adhesive. Face side unjointed.

See for YOURSELF FREE SAMPLE on request!

Available in three thicknesses – 3mm (approx. 1/8"), 4mm and 1/4". ALL orders shipped by special Truck for lowest rates. No order accepted for less than 100 lbs. – equal to (4) 1/4" sheets, (6) 4mm sheets or (8) 3mm.

3mm (1/8") x 3 ft. x 6 ft. – $5.00 value.	4mm x 4 ft. x 8 ft. – $7.50 value.	1/4" x 4 ft. x 8 ft. – $9.50 value.
1.79 PER SHEET	3.89 PER SHEET	4.99 PER SHEET
Minimum order 8 sheets	Min. order 6 sheets	Min. order 4 sheets

TRANSLUCENT FIBERGLASS PANELS – All Colors – Full Sheet Sizes. Only 49¢ per square foot. Write for Full Details. Another Palley Bargain !



3400 RPM ½ HP POWER SAW

compares to saws selling up to 49.50

Ideal for HOME or SHOP

19.98 Complete with 5½" Blade

NEW

RIPS—CROSSCUTS

CUTS A FINISHED 2X4 LIKE A KNIFE THROUGH HOT BUTTER!

A rugged, professional type, adjustable saw. Cut any angle, 0 to 45°. Has adjustable (0 to 6") rip fence. Safety-trigger switch on handle. Full ½ HP Universal AC-DC, 110-120 Volt, 60 cycle motor. Weighs 6½ lbs.

EXTRA SAW BLADES – Available in Rip, Crosscut or Combination. Please specify. . . . . price each 2.95

12 PIECE IMPORTED SPORTSMANS COMBINATION KNIFE

12.95 VALUE

COMPLETE CAMP KIT ONLY 4.95 INCLUDING BELT HOLSTER

The perfect GIFT for Sportsmen, Campers, Boyscouts, etc. Never before sold at our Special LOW PRICE! Ruggedly made to last a lifetime. Top quality steel blade. Handsome Bone handle. Includes 12 everyday and outdoor tools. Carry your Knife, Fork and Spoon plus eight other tools in one compact case. Fits securely into a genuine leather belt holster. Size closed 4-5/8" long.

ARMY CANTEEN, CUP AND BELT

Genuine U.S. Army equipment. Consists of a first quality 1 quart Canteen and aluminum Cup with folding handle, both of which fit snugly into an insulated canvas cover. Cover attaches to web type pistol belt ONLY 2.59

MARINE BOLO KNIFE AND CASE 1.98

Made of top quality Vanadium steel. 15" long. Ideal for clearing brush. With sturdy belt sheath.

U.S. ARMY MACHETTE 1.98 NEW

Has 18" Vanadium steel blade. A hardwood handle. Sturdy belt sheath. 23" overall . . .

NEW ARMY STEEL-FRAME RUCKSACK

The type used by ski troops. Rucksack made of extra steong Army Duck. Has one large inner compartment and three outside pockets with strap-down covers. Entire pac is mounted on special lightweight, all-steel tubular frame. Ideal for hunters, hikers, campers, boy scouts. 8.95 12.50 VALUE

SAVE UP TO 50% ON SPORT DIVING EQUIPMENT

BUILD YOUR OWN DIVING LUNG – SAVE

up to $100. Our special folder contains complete instructions showing how it's done. Kit includes Air Bottles, Pressure Regulator, Hoses, Safety Belt, Shoulder Harness, Clamps, Mouth Piece, Valves, etc. . . . . .

Price for above kit . . . With 2 Bottles (1 hour time) 45.95 $150.00 value

FREE CATALOG Has latest info. on Diving Equipment. Plus an illustrated and described article on "How to build your own Diving Lung"

PALLEY BARGAINS IN DIVING EQUIPMENT

GENUINE AN-6004-1 Type DILUTOR DEMAND PRESSURE REGULATOR

Recommended type. Gives proper regulation of air on demand. . . . 10.95

NEW 12.00 VAL.

AIR HOSE ASSEMBLY

For use with pressure regulator. Has vulcanized mouthpiece. 5.95

CARTRIDGE BELT

Pockets allow distribution of ballast weights around waist. 89¢

COMPRESSED AIR TANKS

I.C.C. approved and dated. Will stand pressure of 1800 PSI.

22 cu. ft. cap. (30 min. time limit). No valve. . 9.75

38 cu. ft. cap. (45 min. time limit). No valve. 12.75

48 cu. ft. cap. (1 hour time limit. Without valve. ONLY 15.95

CONTROL VALVE for above bottles. $3.00

TWO-TANK CONNECTOR. Doubles diving time. 4.95

SINGLE TANK CONNECTORS – $3.95

NEW

PAL SWIM FINS

New, first grade. Of top quality flexible rubber with treaded bottom and adjustable heel strap. Will float and are fully waxed for speed and protection. Vented for air and drainage. Sizes: Small, Med., large. 2.99

DIVING MASK WITH 2 BUILT-IN SNORKLE TUBES

The famous Medusa mask. Fully covers both mouth & nose. Top quality. Has Two built-in snorkle breathing tubes. 8.95 NEW

DIVING MASKS

Made of gum rubber with a sturdy glass lens and adjustable head strap. A Bargain!

SMALL 99¢ MED. 1.49 LARGE 1.89

NEW FROGMAN SUITS

Of finest quality seamless Latex rubber. Two piece type. Factory seconds with minor imperfections, but guaranteed. With either long or short arms and legs. Please specify. $54.95 val. 24.95

NEW CRESSI PINOCCHIO DIVING MASK

A specially designed Italian Mask that brings the lens close to the eyes. In addition the mask's Pinocchio nose allows you to grasp the nose between the fingers & blow out to relieve pressure on the ears. Lens is 3/16" tempered safety glass. GUARANTEED ! 5.95

NEW CRESSI SPEAR GUNS

Imported from Italy. Specially designed for perfect balance and easy one-hand operation. All parts non-corrosive. Powered by special compression springs. Guaranteed!

No. 100 – Designed for fishing around coral, kelp beds & rocks. With spear, spearhead, nylon line & charger. Lgth. 45". Weight 3 lb., 6 ozs. 23.95

No. 300 – More power for the expert. Lgth. 77". With spear, line, etc. . . $26.95

No. 500 – Super power for experts. Lgth. assembled 69". With spear, etc. . . $32.50

U.S. NAVY CHEST WADERS

Made to top Gov't specifications. of finest quality rubber with warm felt inner lining. Comes up to your chest. Have built-in boots, shoulder straps & vulcanized seams. $25.00 value. Sizes: Med., Large. 7.95 NEW

NEW NAVY WADING BOOTS

A Surplus Bargain. Made of top quality, rubberized NYLON – vulcanized to Latex rubber shoe. Shoe is insulated against cold and has grip-tred sole. Boot is thigh height. Order one size larger than shoes. Sizes: 8, 9, 10, 11. 3.49

NAVY WADING SUIT

Makes Surf or Deep Stream Fishing a pleasure. Also ideal for use when it is necessary to protect the body or clothes from mud, moisture, etc. Made to top Gov't specifications. Originally made for use in landing operations. Of heavy duty rubberized canvas with vulcanized seams. Built-in rubber boots & gloves. Sizes: Med. & Lg. A $35.00 VALUE 9.95 NEW

PORTABLE ICE PAC

Ideal for icing down & packing small game, fish, etc. War Surplus. Made of heavy duty neoprene rubber with an insulated core and cover. Adjustable pack straps. Two sizes –

12" x 7" x 16" 1.49 20½" x 16½" x 11¼" 2.49

ORDER FROM THIS AD. Pay by Money Order or Check. 1/2 deposit with C.O.D.s. P.O.s accepted from D&B firms. All prices F.O.B. Los Angeles.

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[*Continued from page 264*]

cables between the towers. Back and forth, day and night, the spinning wheels will move until they have carried across about 27,000 wires for each of the four cables, well over 100,000 miles altogether, or enough to erect four or five clotheslines around the equator. Then each bunch of 27,000 wires will be squeezed together, by machines and men, and bound with more galvanized wire.

Two anchorages, big boulders of concrete, one behind each bridge tower, will be built on shore. These will hold the ends of the cables. "They work," says Mr. Kyle, "like a ship's anchor." But they are much heavier. They will weigh about a million tons—half a million tons apiece.

To add the roadway (that is, to hang loads on the clotheslines), hundreds of suspender ropes will be hung straight down from the big cables of the bridge. Traveling derricks atop each of the two towers will hoist up the first prefabricated sections of the roadway. These first sections will be fastened to lower ends of suspender ropes right next to each tower, and to the tower itself.

Then the derricks will move out onto the roadway sections, and hoist other sections. These, in turn, will be fastened to the lower ends of the suspender ropes, and to the section already in place.

As both sides of the roadway stretch out toward the center, Mr. Kyle and Mr. Decancq will sweat with worry. There was the Quebec bridge. At this stage, before the two sides met, 9,000 tons of it crashed into the water.

"When she meets in the middle," says Mr. Kyle, "you breathe easy for the first time. You've got the backbone in the animal at that point."

The entire bridge will be painted with red lead. Then it will be coated, according to Mr. Kyle's present plans, with aluminum paint. "Little fine particles of aluminum," he says, "lay over each other like fish scales. This gives added protection." The silver-colored aluminum paint also will glitter in the sun, brighten even a gray day and give the United States an Eastern silver gateway to match the Golden Gate.

Over this bridge, commerce of infinitely greater value than that borne upon the treasure-laden waters of the Narrows will move. The bridge will be part of a system of expressways that, by-passing Manhattan, will link the South to New England. And its toll gates will permit a car to enter each lane every five seconds.

This parade of traffic can go on indefinitely. "Steel properly maintained," says Mr. Kyle, "does not deteriorate. Neither does concrete, except for a little surface wear." The Brooklyn Bridge, New York's first steel-wire suspension span, today is carrying its biggest loads after 75 years in use. It is conceivable, at least, that each lane of the Narrows Bridge will receive a car every few seconds for 200 years before a major overhaul. END

NEXT MONTH . . .

A Surprise Party for Gus Wilson

JUST 30 years ago next month POPULAR SCIENCE printed the first story about good, gray Gus Wilson, proprietor of the Model Garage. To celebrate the anniversary, we are planning an illustrated history of Gus's career and a special story about his latest adventure. All of Gus's hundreds of thousands of friends, old and new, will want to read about this surprise party for the world's best-known auto mechanic in our July issue.

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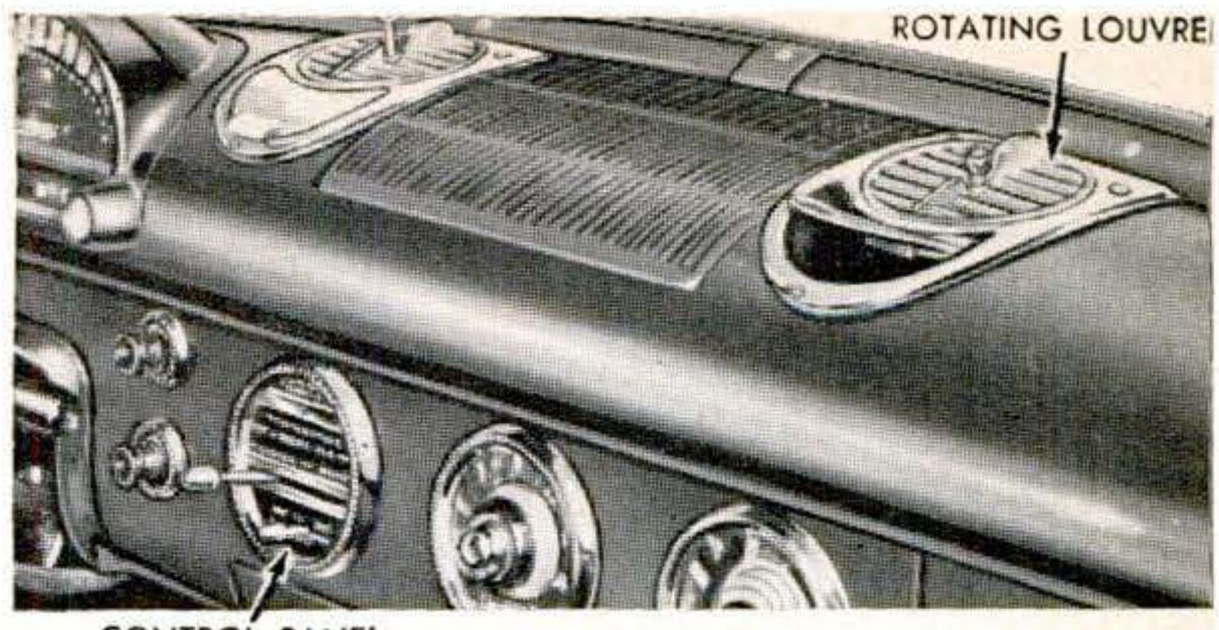
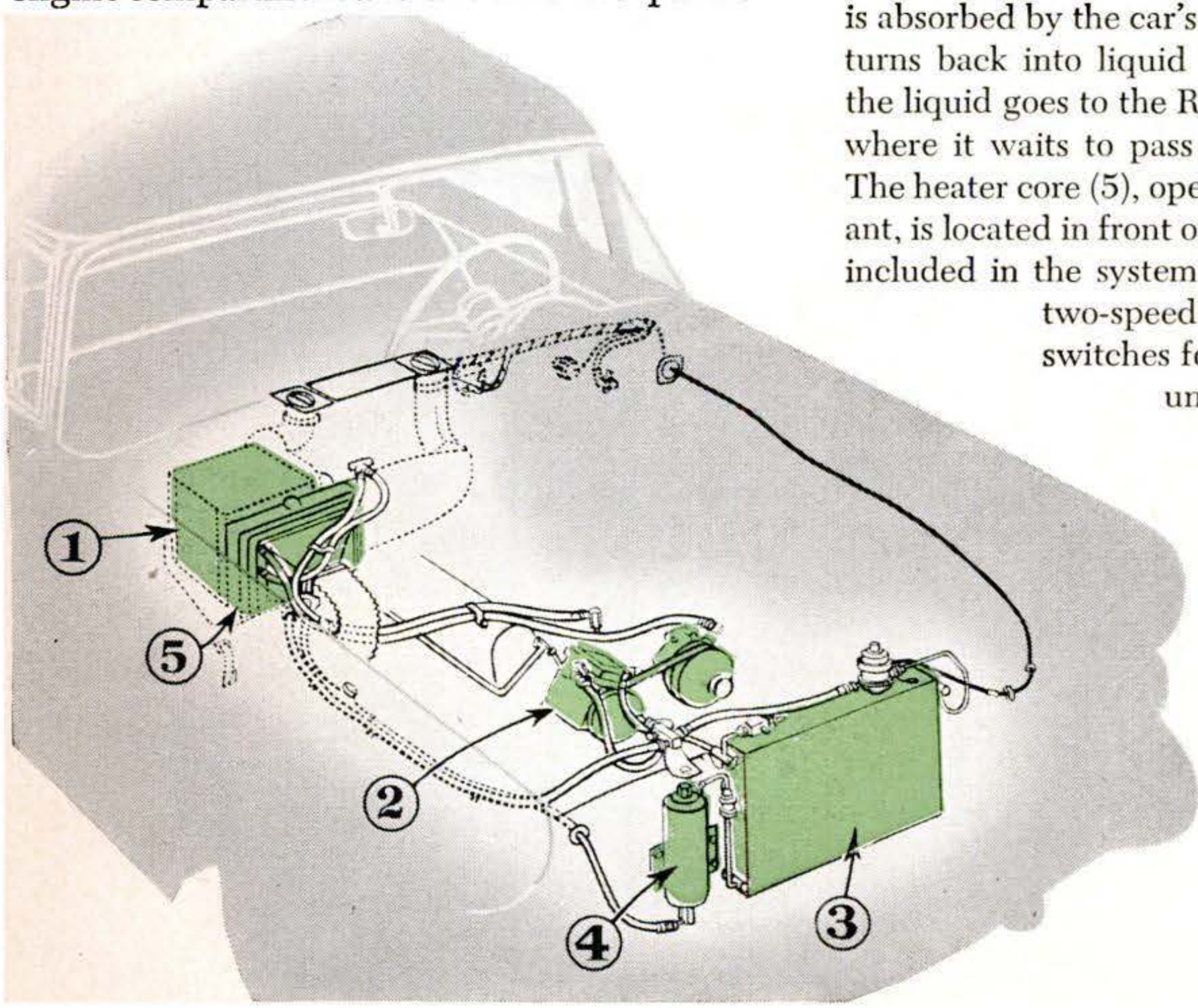


NOW...a single system for cooling, heating, ventilating, defrosting provides desired "climate" in your car under all weather conditions

Another great Ford engineering achievement . . . so simply designed that one sliding lever adjusts for maximum cooling or for average heating. Air circulation is controlled by a two-position blower, while two rotating louvers atop instrument panel distribute air in any direction for passenger comfort and defrosting. Entire unit is installed forward in engine compartment and under control panel!

HERE'S HOW IT WORKS

Cooling takes place in the Evaporator (1) located under the control panel. Liquid Freon-12 expands, turns into gas, absorbing heat from inside the car. Gas then goes to the belt-driven compressor (2). High pressure gas goes next to the Condenser (3) which is located in front of Ford's radiator. Here, heat is absorbed by the car's airstream and the gas turns back into liquid Freon-12. From here the liquid goes to the Receiver (4) a reservoir where it waits to pass through cycle again. The heater core (5), operating on engine coolant, is located in front of the Evaporator. Also included in the system is a by-pass valve, a two-speed blower, thermostatic switches for cooling and heating units plus the necessary ducts and wiring.



Nothing takes up passenger or luggage space

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BARGAINS

IS THE ONLY BIG TABLOID PUBLICATION in Existence That Tells You WHERE & HOW —EVERY MONTH—

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- **To Buy Items at Wholesale! • At Below Wholesale!**
- **To Buy Many New & Unusual Items!**
- **To Obtain Information on Rare Money Making Offers!**

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ONE issue of this Sensational NEW publication can save you MORE MONEY than the cost of the entire subscription! You can BUY BETTER, CHEAPER, NEWER THINGS EVERY MONTH OF THE YEAR! Today, when your dollar buys so little, you absolutely need every single issue of BARGAINS in order to get the MOST FROM EVERY PENNY YOU SPEND. Each issue carries HUNDREDS of bargain offers . . . many times SO EXTRAORDINARY that it's hard to believe that they're GENUINE! Buying at WHOLESALE, BANKRUPT, SURPLUS, CLOSEOUT PRICES can save you from 40c to 80c or more on every dollar you spend! THIS MAY BE HARD TO BELIEVE, BUT IT IS THE TRUTH!

YOU Can make FANTASTIC PROFITS Buying Up Bargain Merchandise CHEAP and Selling It CHEAP

Thousands of Agents, Salesmen, Dealers are subscribers to "BARGAINS". They want to know where to buy BEST in order to sell at low prices for BIG PROFITS. NO REASON why you CAN'T DO THE SAME! Special articles in BARGAINS give you valuable tips on HOW to sell these bargains for BIG PROFITS. And you know, EVERYBODY is looking for bargains these days . . . in fact, this is the only kind of merchandise that is being sold in tremendous volume. Ask any big businessman!

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". . . Received my 1st issue and may I say IT IS A GREAT MAGAZINE."—M. C., Ark.

". . . I am very pleased with BARGAINS. I have never seen anything like it."—Mrs. D. M., Maine.

". . . Just received my 1st copy of "Bargains" and believe me, it is all that you claimed it to be."—T. A., N. Y.

". . . I was the recipient of my 1st copy a few days ago. I am completely satisfied with the periodical. I also wish to express my appreciation to you for having made the magazine available to me. I shall be pleased to continue my subscription as long as the magazine is available." —W. S., Wash.

Every One OF THESE LETTERS ARE IN OUR FILES & WERE NOT SOLICITED IN ANY WAY OR MANNER!

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You won't find this feature in ANY OTHER MAGAZINE. ONLY "BARGAINS" has it. For subscribers ONLY, each month it negotiates bargain offers in famous merchandise at LOW WHOLESALE PRICES and then offers them to subscribers AT NO PROFIT! Enables you to buy in small lots—singly or in quantity at the same prices (sometimes even lower) than dealers are paying! This SINGLE FEATURE OF BARGAINS IS WORTH THE LOW SUBSCRIPTION PRICE A DOZEN TIMES OVER. Yet, it's only ONE feature among many to be found! Yes, Just one!

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We honestly believe that it's possible to SAVE up to $1,000—and EARN up to $3,000 within a year by reading "BARGAINS" EVERY MONTH! WHY NOT PROVE THIS FOR YOURSELF!

Your subscription will automatically include the BIG 1955 CHRISTMAS SPECIAL ISSUE . . . jam full of terrific, eye opening holiday BARGAINS! JUST $2.00—17c per month gives you 12 great money saving issues of BARGAINS!

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LET'S FACE IT . . . Claims, promises are easily made on paper. You may or may not believe all we say here. BUT can you go wrong in subscribing to "Bargains" on this iron-clad MONEY BACK GUARANTEE . . . Your money back IN FULL if the first issue that you receive doesn't please you! Can any offer be more POSITIVE, more FAIR than this POWERFUL guarantee?

Tower Press, Inc., P. O. Box 591-ST, Lynn, Mass.

Here's a FEW Samples of the Bargains Usually Found in "BARGAINS"!

- PENCILS, 57½¢ per Gross!
- 25¢ Rudolph the Reindeer Brooches, 2¢ each!
- Plastic Toy GUNS, 2¢ each!
- $1. Mufflers, Scarfs, 12½¢ each!
- Double edge razor blades, $1.50 per 1000!
- LADIES APRONS, 6¼¢ each!
- $2.50 WALLETS, 30¢ each!
- $1. val. BILLFOLDS, 15¢ each!
- $1. Kiddies handbags, 3¢ each!
- CIGARETTE HOLDERS, 1¢ each!
- BUTTONS, 144 for 25¢!
- NEW Phono records, 78 & 45 r.p.m., 7¢ each!
- 69¢ Insect Repellent, 5¢ each!
- New 20" T.V. Pic. tubes, $21.95 each!
- Famous brand $18.75 perfume, $1. each!
- 49¢ Xmas window decorations, 10¢ per set!
- $1-$3 Hard cover books, 20¢ each!
- $200.00 Surplus typewriters, $23.00 each!
- 50¢ Everyday greeting cards, 7¢ per box!
- $1.95 Men's Silk Ties, 12½¢ each!
- $1. val. personal cloth name tapes, 40¢ for 72!
- 39¢ Under arm deodorant, 2¢ jar!
- $1. Automatic card shufflers, 9¢ each!
- NEW HAIRNETS, ½¢ each!
- $15.00 Electric Percolators, $5.00 each!
- $1.75 Rudolph Reindeer kiddies toiletry sets, 35¢ each!
- $5.50 Lucite Hairbrushes, 65¢ each!
- New Bobby Pins, 70¢ per 700 pins!
- $10. Men's Toiletry Sets, 60¢ each!
- Calendar Wrist Watches, $5. each!
- Christmas Seals, 25¢ per 1000!
- $2.98 Horserace game records, 30¢ each!
- **PLUS HUNDREDS OF OTHER SENSATIONAL BUYS!**

(Above list merely illustrates type of bargains usually found in this paper. Lists naturally change from month to month.) Pro rate prices based on quantity buys.

"Tear out Coupon. Mail NOW—at once!"

Tower Press, Inc., P. O. Box 591-ST, Lynn, Mass.

O.K. Here's my $2.00 for 1 year subscription. Rush me 1st copy!

Name.....

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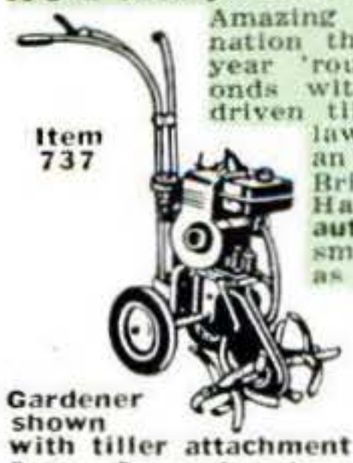
NEW! MASTER Tiller-Mower

It's a rotary mower! It's a rotary tiller



Item 737

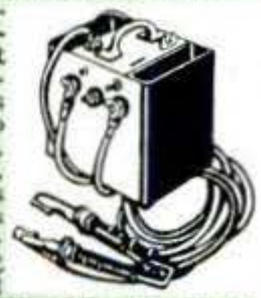
Amazing new gardener combination that works for you the year 'round. Switches in seconds without tools from gear driven tiller to big 20" rotary lawn mower! Powered by an easy starting 2 HP Briggs & Stratton engine. Has exclusive built-in **automatic clutch** which smoothly engages power as throttle is opened. Tiller transmission sealed in grease for years of smooth operation. Non clogging steel tines till or cultivate soil down to 8" depth. Perfect for cultivating—ends backbreaking hoeing and weeding. Tiller propels itself forward—no pushing necessary. 20" mower attaches in less than 1 minute, does a perfect job—cuts any grass (short or tall) velvet smooth! Mulches as it cuts—eliminates raking. Years ahead of other mowers and tillers.

Gardener shown with tiller attachment

Rotary Power Attachment

Basic power unit, factory price.. **$69.50**
Tiller Attachment complete.....**$40.00**
20" Rotary Mower Attachment—737a $49.50
Easy payment plan available. Freight paid east of Rockies—half paid elsewhere.

FLASH-WELD SOLDER GUN



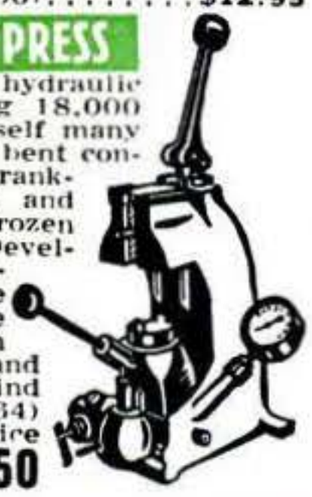
High powered double transformer soldering gun that converts ordinary 115 v. current to instant heat for big soldering jobs! Installs or removes copper pipe fittings in two seconds! Applies solder lugs, heats tools for hardening, provides heat for continuous sheet metal soldering. Saves at least 50% labor time. Includes complete heating unit transformer, heavy cables and grip type soldering pliers. Wt. 38 lbs. (Item 777) Reg. $79.50, Close-out **$39.50**

EXTENSION CORD

Heavy duty and very flexible, Neoprene 14-2 cable, 20 year quality. Wt. 12 lbs. (Item 185) 100 ft. Complete with rubber plug and outlet. A terrific buy at only **$8.95**

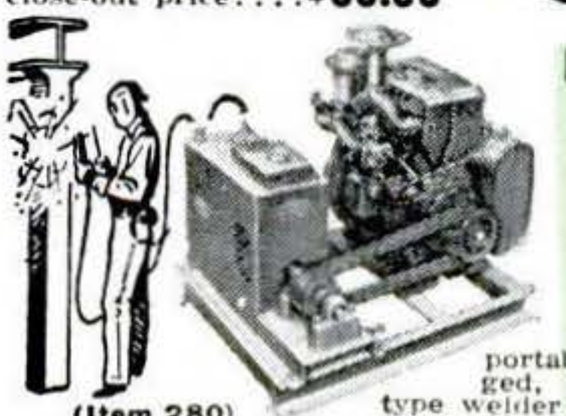
NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lbs. **$6.95.** 100 ft. (Item 200).....**$12.95**

9 TON HYDRAULIC PRESS



A tremendously powerful hydraulic press, capable of exerting 18,000 lbs. pressure. Pays for itself many times over—straightening bent connecting rods, king pins, crankshafts, axles, link pins and bars — or pushing out frozen bearings and bushings. Developed pressure under precise control and visible at all times on accurate gauge. Complete with both large and small anvils and jigs to straighten **any** kind of curve or bend. (Item 464) Wt. 110 lb. Actual list price $365. Our special close-out price....**$69.50**

MASTER DC ARC WELDERS



(Item 280)

Now! a portable, rugged, industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to 1/4" rods. Built-in stabilizer and cooling system makes arc easy to strike and hold. Dual control rheostat provides low heat soldering, brazing and welding from 30 to 300 amps. Complete with instructions, guarantee and **triple** V-belt or flat pulley. You can pay more, but you can't buy a better welder.

WELDER ONLY — DUAL CONTROL MODEL. Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 38a.) Wt. 110 lbs. $450 value..... **$119.50**

WELDER ONLY—STANDARD MODEL. Same as above but with single rheostat for heavy metal welding only. (Item 38.) Wt. 110 lbs. $400 value. Special.. **$99.75**

COMPLETE POWER MASTER (Illustrated above) powered by a 14.6 hp., air cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compares with welder costing $1200. Factory Special..... **$449.50**

WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at...**$10.50**

get BEDROCK factory prices from MASTER MECHANIC

(Item 24)

600-700 WATTS
PUSH BUTTON START

115 v. 60 cyc. AC Powered by a rugged 2 HP easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24.) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. $275 value.... **$143.50**

1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output..... **$199.50**

1300-1500 Watt Plant
115v. 60 cyc. AC Push Button Start. Powered by a 3½ HP. Clinton engine. Combines big output with easy portability. Provides emergency power for operating any oil burner, sump pump, freezer, television, lights, communications systems, etc., which require up to 1500 watts. (Item 22) Wt. 110 lbs. Reg. $475 value, Factory price... **$239.50**

2500 WATT PLANT—Push Button Start (Item 21) 110 120 60 cyc. A.C. A rugged, powerful plant. Reg. $645. Spec. **$329.50**

3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. $760. Factory Price **$379 50**

Dual Voltage 110 220 available for above plants for $30.00 additional.

We make every type and size of light plants —Write, giving us your requirements!

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM).

8" Pipe, wt. 5 lb.....**$6.85**
9" Pipe, wt. 6 lb.....**$7.85**
10" Pipe, wt. 7 lb.....**$8.85**
12" Pipe, wt. 8 lb.....**$9.85**

HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E).....**$11.95**
12" Fan. wt. 10 lbs. (Item 10D)....**$12.95**

JET FLOW BLOWER

Tremendous air movement (1800 CFM) and quiet operation make this double inlet 10" turbine blower unbeatable for heating, cooling, drying and air conditioning. Ideal for attic or barn ventilation, converting gravity heating to forced air; spray booth exhausts, etc. Operates with any 1/4, 1/3 or 1/2 HP motor. Oversized, long life bearings. Includes variable speed motor pulley and belt. Dimensions 19" hi x 18" x 16½". Outlet opening 13" x 11⅜". Wt. 45 lbs. Item 245. Reg. $54.50. Factory Special..... **$27.50**

HEAVY DUTY 1/4 HP motor for above **$16.95**

12" TURBINE BLOWER Similar to above, but larger with 2400 CFM capacity. Wt. 65 lbs. (Item 245a) Reg. $70.00. Factory Spec. **$34.50**

JET STEAM MASTER

Now, a super efficient portable steam generator that produces live steam at 100 lbs. pressure in 60 seconds from a cold start! Produces large volume of high pressure steam on 2 pints of fuel oil. Instantly cleans sticky grease, dirt, rust, old paint, etc. off implements and road machinery. Pays for itself in a few weeks. Sterilizes soil. Sterilizes as it cleans—milk equipment, etc. Fully automatic—oil fired with new, built-in lifetime bronze water circulating pump. Draws water from faucet or bucket. Simple and safe —anyone can use it; built-in safety valve. Complete with 12 ft. of hi-pressure steam hose and new triple efficiency steam gun that automatically mixes in soap solution if desired. Wt. 250 lbs. Item 463. Special factory price..... **$329.50**

PORTABLE LIGHT PLANTS

GIANT 2000-2500 WATT PLANT

110-120 v. 60 cyc. AC. absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb. Reg. price $585. Special at..... **$299.50**
Same plant with electric self starter (Item 31a)..... **$359.50**
Generator only and control box....$169.50
DUAL VOLTAGE 110-220 available on any of above models for $28.00 additional.

CONDITIONAIRE VENTILATING FANS

Save big money installing your own exhaust fan. Efficient propellor type blade moves huge volume of air quietly and effortlessly. Heavy welded frame — predrilled for easy installation. Just cut opening and bolt in place. **Continuous duty** motors. Ideal for attics, restaurants, garages, barns, chicken houses, etc. Control manually or with thermostat.

Blade	Opening	CFM	Wt.	Item	
16"	18¼"	2925	19 lb.	365a	$27.95
18"	19¼"	3600	27 lb.	365b	$31.95
20"	21¼"	4100	30 lb.	365c	$39.95

HI-FLO Centrifugal PUMP

Completely self-priming! No foot valve **required. Tremendous capacity—100 gal. per min. ! . . Special impeller enables pump to handle muddy or sandy water. Simple to operate—simply start engine and watch the water go. Powered by a rugged, easy-starting 2 HP Briggs engine. Prelubricated sealed bearings for years of heavy low-cost service. Big 1½" Model.** Item 502. **Wt.** 70 lbs. Factory price.... **$134.50**

2" Model (150 gal. per min.) with 2½ HP engine. Item 502a. 90 lbs. Fact. Spec. **$154.50**

BIG JOE Portable Pump

A powerful pump that handles up to 15,000 gal. per hour. Easy to operate. Self-priming (after initial prime), no foot valve needed—resulting in 25% more capacity. Exclusive impeller design provides maximum rate of water per horsepower, yet handles water containing a large percentage of stone, gravel and mud. 2 in. suction and discharge. Powered by an **easy starting 6 hp. Wisconsin engine** and mounted on big rubber tired wheels. Wt. 280 lbs. (Item 280). Special Factory price..... **$299.50**
Same pump mounted on steel skids. Wt. 250 lbs. (Item 503). Factory price..... **$275.00**

52 pc. SOCKET SET

Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome thin wall alloy absolutely the best. Contains a complete set of 28 sockets in ½" drive, ⅜" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. A beautiful set of tools that will handle any job; in a **big** doghouse steel box. Wt. 17 lbs. (Item 205) List price $62.90. Factory special.. **$27.95**

Variable Speed Selector

(Item 68)

Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Employs reliable "trouble free" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: ½-1 hp. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs.: Reg. list $228, $252 and $352. Our prices . . . . **$79.50, $89.50** and **$114.50**

Send check or M.O. Prices f.o.b. Factory. 10 day Money back guarantee. SEND 10c for . . . BIG 1955 Catalog

MASTER MECHANIC MFG. CO., DEPT. 62-K Burlington, Wis.

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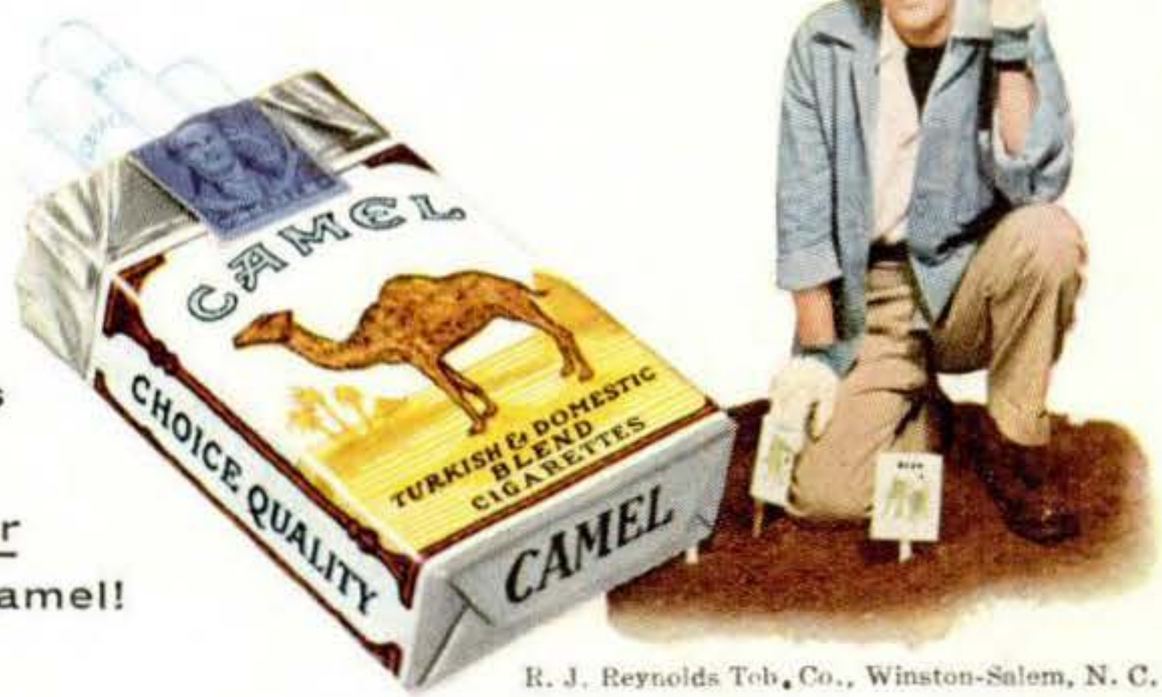

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